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Fabrics for the Waterproofer

By **FRED. GROVE-PALMER, A.I.C.**

THERE is an exceedingly wide range of fabrics which may be used by the waterproofer, and these are woven of practically every known textile fiber. Naturally, however, the greater part of the trade is confined to a few fibers, and many of the cloths that are used have no very extended application. All the same, there are so many in actual commercial use to-day that when the writer had occasion recently to ask a textile manufacturer for a list of suitable cloths for this purpose, there reply came that there are so many that it is difficult to know where to begin.

A rough classification of the fabrics for the waterproofer is:

(a) Heavy goods which are principally employed as reinforcements in beltings, hoses, sheetings, etc.

(b) Light weight cloths which are dyed and utilized by the maker of weatherproof clothing.

The first class will include heavy count unbleached cotton ducks, canvases, and the like, as well as other fibers such as jute, hemp, fiber flax and ramie. The second takes in materials made of silk, rayon, woolens, fine cottons, and a host of mixtures of two or more of these fibers, while occasionally the weavers introduce other vegetable fibers such as fiber flax, China grass, (which resembles ramie) and some fancy yarns.

When it is stated that practically any cloth can be waterproofed, it is well to remember first of all that "waterproof" is not the same as water-resisting—a fact that is not infrequently overlooked. If a material is rendered waterproof all the interstices and pores of the fibers must be filled with a continuous coating of the resistant material, thus making the fabric impervious alike to water and air, as is the case in rubberized goods; but when the cloth is treated with some chemical baths that cause the fibers to be more or less non-absorbent of water, or better, water-repellant, air can still pass through the spaces left in the weave. Such cloths are described as water-resistant and porous as regards air. One patented process for the production of cloths of this type was the celebrated "Cravenette" which became so popular that the word has been largely adopted by the waterproofers to cover any make of material treated in a somewhat similar manner. It is well not to forget that in using this word it is an infringement of patent, just as it is to use the word "Celanese" instead of cellulose acetate rayon.

All fabrics can be rendered water-resistant to a greater or less degree but not all are suited to the purpose from a practical standpoint for one reason or another.

In dealing first with the heavy classes of goods that come into the proofers hands for insertions generally, and also the manufacture of paulins, rickcovers, wagon covers, dunnage, etc., there are a number of important points to be taken into consideration, several of which will be found to apply with equal force to the lighter material used for the making of weatherproof clothing.

The cotton, jute and fiber flax cloths that are to be used in rubber insertions are not mere groundworks upon which rubber is smeared; they are essential parts of the finished body, used to reinforce the rubber and their quality is essentially as important as that of the rubber mixing itself. Take tires, for instance: there the weight of cotton fabric is about equal to that of rubber stock; power beltings and heavy duty hoses are further examples of this parity of importance between the two classes of material that go to the formation of the proofed fabric. The first consideration in these cases is the tensile strength of the fabric foundation for it is upon this that the ultimate strength of the material must be based.

All shipments of cotton canvases and ducks are tested on receipt, both weftways and warpways, in the stretcher or grab. The figures thus obtained, however, must be considered in conjunction with the regain of the fabric as the quantity of hygroscopic moisture it contains has a very important bearing upon the tensile strength. In rayon cloths, for instance, when used for making fancy rainproof coats, the lowering of the strength brought about by an increase of moisture content is entirely out of proportion. It is because of this alteration in the tensile strength that many specifications of fabrics for waterproofing purposes contain a definite percentage of moisture which is to be present at the making of the strength test.

Goods are considered to be "conditioned" when they have absorbed from the ordinary dry air all the possible moisture. The figure is different for each fiber and the standard quantity has been the subject of much research in days gone by. The A.S.T.M. standard for cotton goods is given as 6.5 per cent moisture regain, and the method adopted for estimating the tensile strength at that figure will be found fully described in the A.S.T.M. Standards for 1924, pp. 1137-1145, serial D 36-24. In some places the normal for cotton yarns is taken as 7.834 per cent which, read in another way, means that 100 lb. of dry cotton yarn will take from the atmosphere 8.5 lb. of moisture. In the case of woolen yarns and fabrics, there seems to be no definite standard owing to the fact that different wools vary so greatly; consequently there is a range of figures from 10 to 17 per cent, according to the material. The standard figure for silk is accepted at 11 per cent all over the world, and present practice seems to have put the regain of rayon at the same level, not because it is the right figure but because rayon used to be called "artificial silk" and was lumped in with silk. Indeed, there are several countries even to-day, that habitually include silk and rayon under one heading in their statistics.

The whole subject of hygroscopic moisture or "regain" is of great technical interest in the research laboratory; in ordinary practice its bearing upon the tensile strength test is such that the fabric may be dried in an oven at 105° C. until it reaches a constant weight, the weighting being done in a glass stoppered bottle, before the test is made, thus obtaining a figure for the dry fabric. Other workers prefer to make the test on the stretcher or grab, and ascertain the moisture content afterwards, making the necessary corrections.

In the preparation of waterproof covers for various purposes, attention must be paid to the process which is to be adopted. Some of these do not materially alter the color and appearance of the cloth, others do. In the first case more care will be paid to the weaving than in the latter. The processes in mind which do not bring about much alteration are the aluminum acetate, soap and wax methods; the others include bitumenous inpregnations, oiling, tarring, various copper solutions which produce the green coloration of willesdens, and some of the tanning processes when cutch is used.

Among the principal properties of the lighter cloths intended for weatherproof clothing may be mentioned:

(a) The fastness of the coloring to the chemical process through which the cloth must pass, and then to light and rain alternately, and

(b) The lack of shrinkage when damped,

In addition, the cloth should be free from sizing or dress of any kind, although a certain amount of latitude is allowable in this respect. Moreover, when mordant dyes are used to obtain fast colors, some of the metallic salts that are used for the purpose have an adverse effect upon rubber. This is a point which should not be overlooked, as the rubberproofers refuse to guarantee their work on cloth containing salts of copper even in very minute proportions.

The fastness of the dyes is important because the proofing treatment, whether it be with rubber or with other chemical impregnations, is fairly drastic, being far more severe than anything to which ordinary dress materials, for instance, are likely to be subjected. A dyer without previous experience of coloring goods for the proofing trade might not have much success if he followed his usual procedure in this respect. This is another of those cases in which the dyer lacking experience will do well to consult the dyestuff manufacturers. It is not possible here to give information of practical value as to which dyes can be used owing to the exceedingly wide range of materials that have to be considered.

Not only must the dyes stand up to the chemical treatment, but they are called upon to face more stresses of weather than are those usable on ordinary clothing; rainproofs are exposed equally to bright sunshine and to rain or fog in a great many places that are not blest with very stable weather conditions. In addition, splashing with mud must not affect the color and give rise to spotting. Drops of rain in the big cities and manufacturing districts will be found to contain sulphur dioxide in solution; this will sometimes cause a discharge of the color. Street mud normally has an alkaline reaction caused by the decomposition of organic matter and formation of ammonia. This, in conjunction with other constituents, may cause reactions that show locally and spoil the appearance of the fabric by giving rise to discolored spots.

The curing or vulcanization of rubberized cloth exposes the dye to heated chemicals of a more or less corrosive nature; some of the other impregnating baths are strongly alkaline in reaction. The dyes must be fast to these influences.

One of the largest manufacturers of rayon fabrics recently informed the writer that practically all rayon and rayon-cotton materials can be proofed quite well, and though this is perfectly true on the cloths themselves, it does not necessarily imply that all the dyes used will prove equally resistant to the various influences to which the fabrics would be subjected, even though the world-wide reputation of the manufacturers makes it certain that their dyes will bring them credit under all ordinary circumstances.

It is obvious, therefore, that before a new fabric can be introduced to the waterproofers, very complete tests are needed.

The matter of shrinkage of materials is of very great importance, although this phenomenon is usually more noticeable in woolens and in silk goods, it would be folly to think that cotton is free from the defect, as is popularly supposed. Many forms of cotton yarns shrink very considerably and fabrics which do so should not be used for proofing purposes. In the case of rayon cloths it is not often seen. Fabrics should always be tested for shrinking; this may be done simply by taking a swatch cut to a definite size very carefully and steeping it in hot water for a few minutes. It is left in a wet state overnight and in the morning it should be flattened out, without stretching, and dried at a moderate temperature. It

is then measured again and if it has been found to have decreased in size the fabric cannot be regarded as one suited for proofing. If, on the other hand, there is no reduction in the dimensions after this test, a larger piece also carefully measured should be carried right through the waterproofing process from beginning to end, and then measured. This will make sure that there is not likely to be any stage at which the action of the chemicals has a more contractile effect than pure water.

The dress, sizing or finish that is applied to cloth is as varied in composition as the cloth itself. In rubberizing it is often found that sizes will prevent the close adhesion of the rubber to the fabric that is essential, and some proofers, therefore, insist upon having no dressing. In other processes it is sometimes not so important but in any case it is a matter that requires consideration, and the wishes of the proofers should be carefully studied in this respect. If dressing were to be omitted altogether the hand of the cloth might suffer and consequently the finished product may seem poorer than it should be. It might be mentioned that in rubberizing it has been found that if the rubber is applied by means of spreader the coating will adhere more closely to a sized surface of fabric than if it is put on in a calendering machine. The reason for this does not seem to have been established but it is sufficiently well known for the proofers to avoid taking undue risks; they apply the first coating in the spreader.

In a general way, silk fabrics are weighted with tin-phosphosilicate; sometimes they are afterwards sized with a solution of gelatine or gum tragacanth. Originally all this was done in order to make the material feel better than it really was, but at the present time it is so usual, that it is only when omitted that attention is called to the fact. "Silk" means tin-weighted silk; the other kind is alluded to as "pure, unweighted silk." Rayon cloths are not so often weighted or loaded with chemical matter, although many patents have been taken out for suitable processes; they may be sized, however.

Woolens are dressed with glue, starch, British gum, albumen, sodium, silicate, but not very often. In those countries where high grade woolen fabrics are produced, the great aim is to get them soft and with a characteristic loftiness of hand, for which purpose certain oils are used. These may be the well-known branded compositions freely advertised or a commoner emulsion of olive oil or oleic acid in conjunction with a small amount of ammonia.

The finer cotton goods are slashed with glue, gums, algin, Irish moss, carrauba wax, and other things. They may be loaded with sulphate of calcium, china clay, magnesium sulphate, barytes, chalk, talc, etc. They may be kept in moist condition by the addition of the chlorides of magnesium, calcium or zinc, or with glycerine and glucose. Moulds and fungi are prevented by the addition of borax, boric acid, phenol, formalin and the salts of copper.

That formidable list mentions only around fifty per cent of the chemicals that help in the production of cotton goods, but it is enough to show that fabrics intended for waterproofing must be studied with regard to the manner in which some or any of the additions may affect the results. Allusion has already been made to the bad effect of copper compounds on rubber coatings. They cause separation of the layers and also tend to make the rubber become brittle. This is unfortunate because the after-treatment with copper is of great assistance in increasing the fastness of many of the substantive dyestuffs. On account of the danger arising from even minute traces of copper, the proofer is most careful to test all shipments of dyed cloth for the presence of this metal, which he usually does by making an analysis of the ash.

When the textile manufacturer is preparing fabrics expressly for proofing he has, of course, full knowledge of all deleterious substances and is fully able to dispense with their use by employing other, harmless, chemicals.

The weaving analysis of all fabrics intended for proofing gives some indication of its suitability. The specification of the cloth will indicate the number of warp ends and filling picks there should be. They are always counted by the receiver in order to confirm the quality, and the weight per square yard is also ascertained. The sample piece cut for this should never be less than ten yards in area, and it is more satisfactory to dry it for a couple of hours at 105° C. before weighing; if this is not done the weight will be found to vary quite appreciably from day to day if the weather is unsettled.

The twist of the yarn having a decided bearing upon the tensile strength is a matter of importance to the proofer who will, by unraveling a few threads, test them on a twist counter. Below will be found a selection of specifications for cotton fabrics used in the waterproofing trades:

	Warp	Weft
Duck	50 ends of 3/40s	50 pks. of 2/24s
Belting Duck	23-26 ends of 7s	12-17 pks. of 7s
Jaconettes	40-80 ends of 36s to 44s	40-80 pks. of 36s/44s
Osnaburgs	56 ends of 16s	36 pks. of 8s
Wigans	37 ends of 90s	14 pks. of 16s
Jaganaths	44 to 50 ends of 20s to 26s	36-44 pks. of 16s

There are dozens of others but there is no point in naming any more of them as there is nothing especially noteworthy in the general construction. Strength, closeness and firmness of weave are the principal features aimed at.

Great care is needed in the inspection of all cloths for proofing, especially for rubber work; they must be clean, and any spots of oil or grease are meticulously cleared away because the rubber would not adhere to such places. The cloth store should be maintained at a warm temperature so that the goods cannot get damp and may thus reach the proofing machines in a fit condition. When the proofing process consists of immersion in aqueous solutions this point is not so necessary, but moisture will lead to the formation of bubbles under the rubber coating, and it is very difficult to get rid of them. All weavers' knots must be removed carefully as their presence will give rise to unevenness of the rubberized surface. The fabrics are always passed through the singeing machine

to burn off any hairs and loose fibers there may be; these, too, would prevent the perfect leveling that is necessary for good rubberized cloth.

That general class of heavy goods known as "house cloths" that find so wide a use in the trade, have their chief value in giving strength and rigidity of form to tires, hose, packing sheet, and the like. These are made of cotton, hemp, fiber flax and sometimes jute; they may vary in weight from fine gauzes right up to the heavy, closely woven fabrics for driving beltings. For some purposes, asbestos fiber with or without wire gauze is employed, and for many kinds of paulins and covers jute fabrics, Hessians, are used. Auto tires are made with the finest grades of cotton only, and these fabrics, whether they are made with a close weave or in the more modern way consisting of practically all warp with only sufficient filling to allow them to be handled conveniently, have to undergo the most rigorous series of tests. Embedded in the rubber, the latter have been found to give a stronger structure than the old weaves.

Lighter goods, including air bags, swimming belts and articles of that nature are composed of calico, linen or cotton twill; for some pressure hoses knitgoods have been successfully introduced. Rubber bedsheets are made of pure bleached cotton, in which there is no sizing. These are well washed and are usually dipped in a solution of sodium carbonate before drying; the object of this is to protect the fiber from the action of the vulcanizing process. Balloon fabrics and parachutes are of fine cotton or silk of special weaving construction. Bathing caps, rubber aprons, etc., are often based upon very fine cretonnes or silks. Cotton twills and cambrics, as well as silk, rayon and mixtures, are used for light weight raincoats.

The weight per square yard of fabrics has been alluded to; it is still the practice in some places to refer to the weight per linear yard, an old-fashioned and inconvenient method of expression; everything in this case depends upon the width of the fabric. There are, of course, certain conventions in this respect which the older weavers can carry in their minds as easily as they do their own names. Some of these widths will be found listed below:

	Inches
Duck for tires	36
Duck for hose	40
Duck for beltings	42
Duck for stitched beltings	36
Duck for Army use	28½
Duck, single filling	30
Osnaburgs	30

It is more than probable that if the matter were to be looked into with an unprejudiced mind there would be no reason for all these variations at the present time. The whole matter of standardization of fabrics is ripe for investigation. Almost every department of every government, every railroad company, corporation and firm of waterproofers has each its different specification for each kind of material. It is surely not beyond the capacity of the world to-day to get together and settle some definite standards. In 1926, the Rubber Association of Canada made a good start by adopting a series of standards for belting ducks of various weights ranging from 24 ounces to 32 ounces per yard of 42 or 50 inch widths. This is stated to have been successful during the past four years and might be taken as the basis upon which to found others.

The fact that it is possible to apply rubber coatings or chemical depositions to practically any form of textile material does not necessarily mean that garments made from all types of fabrics will be either waterproof or lasting in wear. That this is so has been well shown during the past few years when various markets have been almost flooded with cheap and showy so-called rainproofs that have been no earthly good to anybody. They failed to keep out the rain, the colors rapidly faded and the fabric itself quickly gave way; there was no satisfaction for the buyer and reputation of the sellers and makers cannot have escaped censure. Indeed, it has been reported from private sources that the effect upon the trade "has been disastrous."

It would be to everyone's advantage if there were more co-operation in the trade so that information might be pooled to some extent. While agreeing that it might not be feasible for every maker to get on the air with the whole of his trade secrets, there might be more exchanging of information with mutual betterment of output. It is undoubted, of course, that the technology of proofing fine silk fabrics differs considerably from that of pressure hose, but many points in the one might be adaptable to the other, and the manufacturers of both would reap the benefit. All this applies with equal force to the makers of textile fabrics for these various purposes. If they are aware of just the processes through which their products are to pass they will be enabled to bring their wide experience to bear upon getting out the most suitable weaves for such purposes. The proofers may hold that they know "all about it," but there are few of us so wise that we have nothing to learn. Much has already been done by existing organizations but much more remains to do.

In those cases in which the proofing firm runs its own dyehouse the maker of the fabrics has its responsibility greatly reduced, but that fact in no way lessens his urgent desire to give of his best for the sake of his commercial reputation.

Hercules Vice-President Returns from Europe

Norman P. Rood, vice-president and director of the Hercules Powder Company, has returned to Wilmington after an extended business trip abroad. Mr. Rood made an analysis of European business conditions with the idea of opening up new markets for Hercules products. While in Europe, he visited the company's foreign connection, the N. V. Hercules Powder Company of Rotterdam, Holland, which handles the European sale of Hercules chemicals.

Spraying Designs on Textiles

By **WILLIAM J. MISKELLA, M.E.**

Consulting Engineer on Finishes and Finishing Problems

ALONG with new spray-guns and a wide variety of compressor units comes the opportunity for the textile man to broaden his scope and include in his regular routine some of the new ideas that are constantly being presented in other lines. This suggestion could not have been made with much force a year ago, but even within the past year many new improvements in equipment and processes have been presented so that it is timely to be thinking of the future of textiles.

Since the spraying process of decoration may be new to many of the readers of this magazine, I might mention that a spraying outfit consists essentially of three divisions: the tools which actually do the decorating work, the machine which makes the compressed air and the accessories which are used to aid in doing the work. The latter may include devices to take out the oil, dirt and moisture from the compressed air (Figure 1) and the cabinets that are used to remove the fumes from the room in which the work is carried out, providing there is much decorative work to be done.

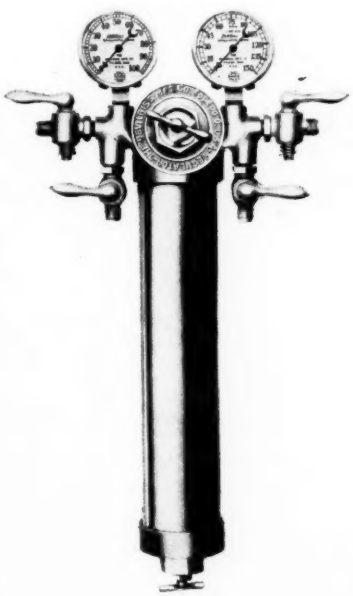


Fig. 1

As an example of how far one may expect to go in this regard, it may be of interest to cite the hundreds of commercial artists who use decorative spray guns without requiring any means of taking the fumes away. Indeed, there are many instances where this fact does not interfere. One may figure it out for himself—its all a question of the amount of material used. When the amount passed through the spray-gun is considerable an exhaust is needed, and when this amount is little an exhaust is not needed. It will not be wise to give this point much consideration at this time except to make a mental note of it and to also observe that those who sell spraying equipment are able to meet any emergency that might arise in this connection. Suffice it to say that men will proceed to decorate textiles with the spray-gun, and when they meet these difficulties a means for overcoming them will be found.

Some wonderful decorative work has been done on such items as wall paper, grass rugs, canvas and other kinds of material, but the surface has only been scratched, and the field is wide open for the artistic and harmonious development of interesting and attractive designs for textiles which are exclusive and in a class by themselves.

In general, the spray-stenciling of textiles is effected by stretching the cloth out on a smooth surface and applying the colored materials through various kinds of single and compound stencils. The surface tension of the spraying liquid, whatever it may be, should be low so that the textile fabric will quickly absorb the material.

Both portable and stationary compressing outfits are now available in a great variety of sizes and shapes; in fact, there is a compressing unit for almost any conceivable situation that might exist. In large plants where a number of spray-guns are in operation it is more economic to have a stationary compressor operated from a line shaft or by an electric motor (Figure 2) which supplies the entire plant with compressed air. Where the individual dealer or user desires to do only an occasional job, the portable units of the size suited to handle the work are more applicable than the stationary type. It is interesting to note that in the painting trades where the spray idea has taken more of a hold than in other lines, many jobs were not considered because compressed air

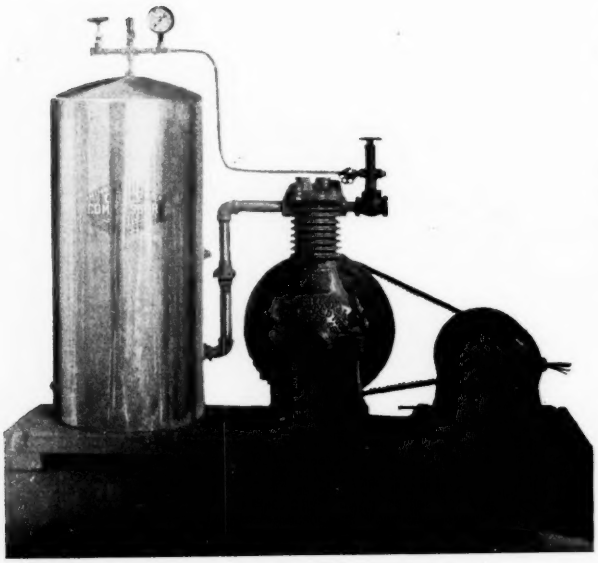


Fig. 2

could not be provided to do the work. This was because there were only large portable compressing outfits in the market.

Here, Figure 3, is an illustration of one of these moderate-priced portable spraying outfits consisting of the compressor driven by a ¾ H.P. electric motor which may be connected to the electric light socket. This outfit

Fig. 3

is classed as a decorators' heavy duty outfit. It has a capacity of 4.8 cubic feet of free air per minute, and to make that figure more understandable, I might say that it furnishes sufficient compressed air to operate a single paint spray for coating surfaces. If desired, two small decorating spray-guns may be used instead of this large coating gun.

This particular outfit is equipped with a 2½" x 3" compressor of the air cooled type, an automatic unloader, an air filter, an endless belt (self-tightening), wheeled base, rubber tired wheels, expansion cooling coil made of copper, oil and water separator and the necessary gauges and fittings. Also, there is included a supply of electrical attachment cord and the necessary rubber air and material hose to operate the outfit. This outfit weighs 240 pounds and is 26" x 26" x 18" dimensions.

The spray-gun used may be of the pistol type in which case the material and the air are made to operate when the trigger is pulled with the forefinger. The material may come to the tip of the spray-gun nozzle either by suction or gravity or even pressure through the hose leading from the pressure tank containing the decorative material.

But for fine artistic and careful work, it is advisable to use the thumb action spray-gun which has the interchangeable color idea well to the fore. This is the same type of gun used by many poster artists and those who are closely allied with real creators of art work.

Modernistic art lends itself to very agreeable adoption of the use of the spray decorating idea in applying designs to textiles. There is a wide field yet untouched by the textile industry and that is wall decorations. These are sure to be developed in the future and when they are the spray idea is certain to play a prominent part either before the cloth is placed on the wall or afterwards, depending upon local conditions.

Incidentally, it would not be proper to overlook the mothproofing application that the spray-gun method has for textile merchants on account of its light weight and dependable operation and its adjustment for fine work. Even the finest fabrics may be treated with this outfit since is insures an even, uniform spray. There is a round strong spray for penetration of the fabric and to reach difficult places, and there is the fine flat, fan-type spray for exposed surfaces.

Basic dyes are used in the spray-decorating of textiles as a rule but sulphur dyes are not used. In fact, it is possible that especially prepared dyes for this purpose will be found to be more economical. This has been true in other lines, and there is no reason to believe that the textile field will be an exception. Such material would cost more per gallon, but it would also be proper to expect it to cover a larger area than the ordinary dyes used.

There is no greater expense involved in this new decorative idea than a small outlay for equipment such as is described in this article, and too much emphasis cannot be placed on the beautiful and artistic effects that are made available, thereby opening the way to high class and renumerative lots of textile patterns which will increase the sales appeal of the finished product and make the prospective customer realize that a radical change has taken place in the art.

By a mere change of the caps and nozzles used in the spray-gun itself, Figure 4, an entirely new effect may be secured. It may be one of veiling, one of spattering or a combination of the two. It seems that it is high time for the evolution of some varigated designs which do not carry the earmarks of machine printing and it appears that this method is at least a step toward the ultimate goal.

Fig. 4

It is interesting to note that blending and other pleasing decorative effects are obtained with the greatest ease by means of the spray-gun. Sometimes it isn't conceivable that uniformity of coverage of a certain pleasing hand-sprayed design could be depended upon in production. However, this fallacy has been demonstrated time and time again in the painting field. It has been almost an every day occurrence to duplicate the impossible.

Indeed, the decorative effects possible are limited only by the user's knowledge of color harmony. Placing these simple and low-priced tools in the hands of a novice creates some interesting effects and before long some of them will be attractive enough to establish as standard specialty patterns.

May I again mention the wonderful field that exists in the interior house decoration classification where ordinary painters have attempted to create pleasing effects on walls, some of which have attracted nation-wide attention. Consider the broad field—tea rooms, hotels, stores, theatre buildings and even factory entrance lobbies, all craving for something better. The opportunity lies in the hands of the textile industry engineers and designers who have the advantage of working out suitable designs and effects in the mill with the aid and advice of as many experts as they care to employ. On the other hand, the expert interior decorator will always be handicapped by having a limited number of workmen capable of doing the acceptable type of work—and then whatever these men do produce or create will be the handiwork of an individual and not that of an organized group.

Take the interest in plastic paints for wall decorations as another example. The market for them has already been proven. Customers are still demanding the Spanish and Travertine effects which have been so popular. Here the textile man has two opportunities—he may make an imitation of the plastic effects just mentioned or he may create something that may be used in connection with the plastic paint as a panel combination—something that will relieve the monotony of the plain globular and trowled treatments accorded these materials in the house decorating industry, and which at the same time will supply something entirely new for the market.

And here is another point of interest to the textile manufacturer—an opportunity to get rid of rejected lots of various kinds of textiles which are not suitable for any uses in vogue at the present time. Textiles used for wall decorations need not be perfect, and the lower price at which they could be offered might save many a heavy loss in rejected material.

Consideration will have to be given to the question of fastness when dealing with cotton, but this problem is only secondary when compared with the start that must be made in the primary operation of creating the varied and unusual effects.

In the case of wool there are treatments that the textile man knows of to increase the affinity of this material for the dyes used in decorating it. In the case of silks and rayon care must be taken to get rid of all grease and oil.

It is possible that some of the textile mills would want to install a more complete outfit for experimental purposes such as practically all paint manufacturers and all owners of research laboratories have in operation in the various establishments throughout the country. Here, for example, Figure 5, is a complete outfit such as the experimental department in a furniture factory might use.

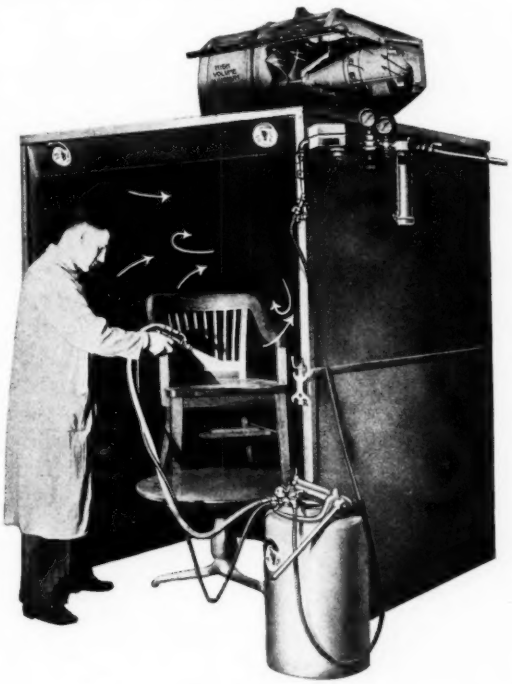


Fig. 5

The white arrows show the direction of the air which is pulled in from the room by the fireproof exhaust mounted on the top of the cabinet. The exhaust may be connected to the outside either through the roof, the wall directly back of the cabinet or off to either side. The object is to provide a metal inclosure in which the work may be done without the inconvenience of having the fumes fly back in the operator's face and perhaps carry to remote parts of the room and thereby spoil some of the work in process.

The material to be applied may be placed in the pressure material container to the right of the operator, shown in the picture in which case the supply to the spray-gun

is automatically fed without having to periodically replenish the suction cup used for handling small amounts of material. From this, the reader will note that there is practically no limit to the production demands that may be placed upon the spraying system, should any real creations be evolved which would demand unforeseen quantities. As an example, should the wall decorating idea take hold and work into a reality, there is no question about the need for a pressure outfit for handling the material. Let me say in passing, that any decorative effect that has been worked out using a small suction-type spray-gun may be quickly adapted to the pressure feed principal. Thus the question of production need never worry anyone who has good ideas he desires to put into effect.

Mention was made of the need for eliminating the oil, and that might call for some additional comments. Wherever compressed air is available in a plant, it is the custom to use it regardless of the fact that in spraying application a better quality of compressed air is needed. This is where the oil comes in. There are hundreds of compressors sold for miscellaneous uses, but very few which consider the refinements demanded in the work of applying dyes, lacquers and other decorative materials. Lacquers, for example, do not mix with oil in large quantities and it should not be expected that they would in small quantities.

Water is one of the enemies of a good paint job, especially when the atmosphere is humid and there is not sufficient drainage in the air lines to remove the moisture that collects. Water-saturated compressed air is undesirable, unless it is to be used in the application of dyes of the water-soluble type.

It should be remembered that the location of the compressor is important. The air is taken in usually from the room in which the compressing machine is installed. Should there be steam from dye vats or dust from some other cause in the air in the vicinity of the air intake of the compressor the difficulty should be remedied by inserting a pipe in the intake end of the compressor and carrying the other end out a distance to a location which will provide the proper quality of air.

The automatic era of spray application is upon us, and it is well to keep in mind the possible application of a certain decorative effect or set of effects by means of automatic spray-guns, such as those shown in Figure 6. This is interesting because it shows the method used to paint circular discs such as cable reel heads four to six feet in diameter. In this case, the guns located near the center of the circular head are adjusted to give a very fine spray while those working near the circumference of the head are adjusted to give a wider effect while at the same time applying more material. Thus, the proper adjustment of the various spray units in the gang shown will actually apply a uniform coat of paint to this circular disc as it revolves on the turntable located directly underneath.

This is mentioned to show the wide variation in the adjustment that is possible when a gang is used, and to prove that there is great possibility of application of the idea to continuously moving rolls of textiles. This is further augmented by the additional effects that may be obtained when a duplicate set of gang sprays is added to the opposite side of the cloth to work simultaneously.

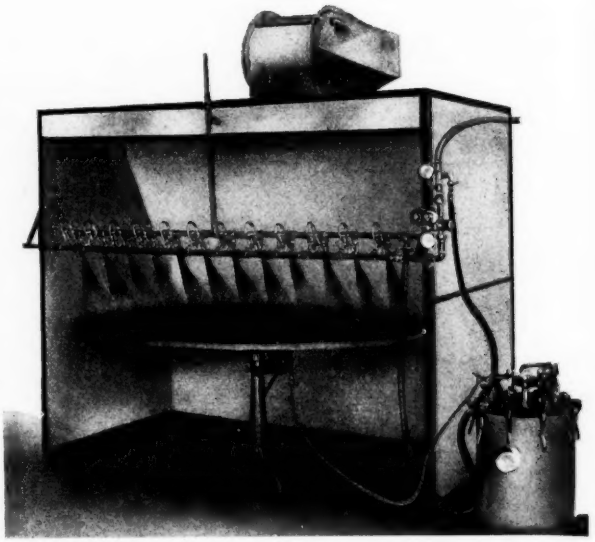


Fig. 6

Then there is always the possibility of working out designs which may be applied by hand with a pressure gun as the cloth passes in a horizontal or vertical direction from one roll to another.

In this article the author has only attempted to touch the high spots so as to give the textile reader a broad conception of the possibilities in store for him when the decorative capability of the system has been worked out and new applications heretofore thought impossible have become a reality.

Du Pont Products Exhibit

Two displays designed to show the application of American made fast dyes are being featured this week at the Du Pont Products Exhibit on the Boardwalk at Atlantic City.

Blankets made by the Beacon Manufacturing Company are shown in one of the large Boardwalk windows. These are in a wide variety of colors and designs including contrasting stripes, bordered effects and Indian motifs.

An interior display occupying the center of the Exhibit presents in a dramatic manner the use of fast dyes for dress fabrics. The focal point is a huge lump of coal from which emerge streamers of fabrics in rainbow hues covered with Cellophane over which there is a constant play of lights. Four stages in the manufacture of dyes, including coal tar, crudes, intermediates and the finished dye, are presented. A wide range of fabrics in plain colors and printed designs completes this display.

Bleaching Cotton Piece Goods with Hydrogen Peroxide

By **H. G. SMOLENS**

Consulting Engineer, Buffalo Electrochemical Co., Inc., Buffalo, N. Y.

HYDROGEN peroxide bleaching of cotton goods is now being done on a fairly large scale in kiers, on a smaller scale on jigs or on string dyeing machines and, in one or two cases, on so-called "continuous machines."

By "kiers" is meant the type of equipment in which the goods are not mechanically moved during the bleaching process, which process may or may not involve forced circulation.

No direct bleaching cost comparisons of these three systems can be made now, because we do not know, by probably a wide margin, just what the minimum costs can be in any one of them and because no even fairly ideal type of equipment for hydrogen peroxide bleaching of cotton goods has, as yet, been put into operation.

At the present time, all of the three systems can be made, except in extraordinary cases, to produce well bleached goods at reasonable costs, but any hydrogen peroxide bleaching process of cotton goods, in large quantities, still requires considerable experimental work. However, the underlying principles of cotton bleaching with peroxides, have been fairly well established, so that the necessary experimental work can be done with more intelligence than was possible even two or three years ago, and with no spoilage.

Kier Bleaching

The first question usually asked regarding peroxide bleach kier boiling is *does it work?*

Enough kier bleaching with hydrogen peroxide has been done in the past three years and is in successful operation now, to answer this question in the affirmative.

The second and equally important question is *does it pay?*

To this there is no inclusive answer. A peroxide bleach kier boiling operation, just like any other cotton finishing process, may pay quite handsomely in one bleachery, but be entirely too expensive in another bleachery on even the same lines of goods.

The following general statements, based on considerable experience in peroxide bleaching, may be used as a rough basis of estimating the possible value, to any bleachery or finishing plant, of peroxide bleach kier boiling:

1—About 75% of the estimated cost of this bleaching, from the grey room to the white bin, is in the kier room. This cost is almost entirely a matter of poundage of cloth, not of yardage. Therefore, in every bleachery, there may be a yardage per pound of cloth figure, above which it is more economical to bleach with peroxide than in any other way. For example, there is practically the same cost involved in peroxide bleach kier boiling 25,000 yards of a four-yard, 80 x 80 print cloth as there is in peroxide bleach kier boiling about 12,000 yards of a two-yard twill, or in peroxide bleach kier boiling about 50,000 yards of an 8.20 marquisette. Very light weight goods can, in almost every bleachery, be given a peroxide bleach boil at a total cost lower than that of the usual boil and chemic bleach.

2—In many cases a single peroxide bleach kier boil will produce a bleached bottom that is as good as one requiring a double caustic boil and chemic. This, of course, very materially enters into a cost calculation.

3—The cloth comes through the peroxide bleach boil process soft, permanently white and with a markedly fine handle. As a result it is very much less likely to be returned by either the finishing department or by the customer for harshness, sleaziness or general faulty appearance.

4—The strength of a single boil peroxide bleach processed cloth is usually greater than that of cloth that has been given even a single boil and chemic processing, averaging over 10% in both warp and filling.

5—The colors of reasonably fast colored yarn goods are brightened and improved by the peroxide bleaching process. Such goods require no after-treatments whatsoever.

6—For any given floor space greater production is possible.

7—Water and steam consumption may be materially reduced.

8—Often an additional gain in yardage, or a reduction in yardage loss, which the peroxide bleaching process allows, may more than pay for the entire cost of the peroxide bleaching chemicals.

There are so many ways in which successful peroxide bleach kier boiling can be done, that almost everybody who has any interest in peroxide bleaching chemicals or in peroxide bleaching of cotton goods, has very pronounced ideas of the "best" way in which it should be done. As a matter of fact, there is no more a single

best way of doing peroxide bleaching than there is a best way of doing caustic boiling or of doing chemic bleaching. Furthermore, what may look like a very good peroxide bleaching process to-day, may become more or less obsolete in even a few months, as our knowledge of peroxides and of peroxide bleaching of cotton goods is continually increasing.

However, no matter what the actual process may be, the essential factors of economical and successful kier bleaching of cotton goods with hydrogen peroxide, are the following:

1—A hydrogen peroxide which, in fairly strong alkaline solutions, can, without undue decomposition, stand a boiling and a circulating in the ordinary steel kier.

2—A formula or formulae containing scientifically and practically correct quantities and proportions of all the peroxide bleaching chemicals necessary to give the desired bleached bottom to the goods.

3—A thorough and level impregnation of the goods with these chemicals.

4—Heat.

5—Circulation.

Of all these factors, only the last two, heat and circulation, are dependent on the kier itself. Therefore, any kind of a kier, which, while packed with cotton goods, will properly heat and circulate an alkaline solution, should be and usually is suitable for peroxide bleach kier boiling.

Ordinarily, however, grey goods, tightly packed in a kier, do not allow an easy passage to a peroxide bleaching solution. The grey goods may, therefore, not be thoroughly or levelly impregnated with the peroxide bleaching chemicals and as a result, may not be well or evenly bleached. It is customary for everyone, except the kier manufacturer, to blame faulty peroxide bleaching on the kier. If the kier, properly operated, has done its designated work of heating and circulating the liquor, the trouble may be in the condition of the grey goods, in the preparation and value of the peroxide bleaching solution or in both.

If the original grey goods are too resistant to their penetration and passage by the peroxide bleaching liquor, it is necessary to prepare them in such a manner as to remove or reduce this resistance, before the actual bleach boiling is attempted.

Goods mercerized in the grey and then thoroughly washed are usually fairly well wet out and may be run directly from the washer into the peroxide bleaching kier. Care must be taken, however, that such goods, especially if they contain colored yarns, do not retain more caustic than the kier bleach requires.

A peroxide bleach kier boiling process usually does not change the initial procedure on goods that are singed, steeped and washed, or on goods that are singed, grey soured and washed. In general, where experience has indicated the necessity of any preliminary preparation of grey goods for the chemic bleach, it will be found that a similar pretreatment is required for the peroxide bleach boil.

Unless all of the peroxide bleaching chemicals are properly selected and mixed in the first place, it may be too expensive or even impossible to do successful kier bleaching. In too many cases, this has been, and still is, more or less disregarded, and most of the attention is given to manipulating the kiers. It must be remembered that peroxide bleaching in kiers is not a matter of kier circulation. It is a chemical process based on chemical reactions which are not any too well known. The heating and circulation are incidental to this main point. In fact, it is possible to do very good peroxide bleaching of cotton goods at room temperature and with no mechanical circulation of either the liquor or the cloth. Therefore, the major attention belongs to the chemistry of the peroxide bleaching process itself, rather than to the mechanical details of any kier systems.

Jig Bleaching

Cotton goods that should not be handled in rope form, may be easily and economically peroxide bleached on jigs. This is usually done in one of the following two ways:

In the first, the roll of grey goods is put on the jig and is wet out and bleached by a single peroxide bleach liquor. This process requires from eight to twelve ends at regular jig speed, depending on the grade of the cotton and on the construction of the cloth. The exhaust liquor is then dropped and the cloth is washed, and tinted or dyed, without removal from the jig.

In the second, the roll of grey goods is wet out, or even boiled out, on one jig or in an open width washing machine, and is then transferred to a second jig for the actual bleaching. The bleach jig is operated with a standing liquor which allows the economical use of concentrated peroxide bleach solutions, thereby very materially increasing the speed of the bleaching. From two to six ends are required for this form of bleaching, depending on the construction of the cloth and on the degree of wetting out which the cloth has previously received.

Jig bleaching with hydrogen peroxide is suitable for cotton warp rayon filled goods, especially when the grey goods are oily. Such goods come through the peroxide bleaching process with an excellent luster and feel, and rayon is not tendered, even when the cotton has a great many motes that must be bleached out.

String Dyeing Machine Bleaching

When the production of bleached goods is small or when the bleaching is intermittent, a string dyeing machine of the usual type is entirely satisfactory for the peroxide bleaching process. The operation of such a machine is similar, in the application of the peroxide bleaching chemicals, to the operation of a jig.

Continuous Machine Bleaching

In any continuous machine, the bottoming and the bleaching are almost entirely chemical problems, since each portion of the cloth should be subjected to the same solutions for the same length of time under the same conditions. Therefore, the chances of unevenness, which are inherent to the ordinary kier circulating systems, are in such machines practically nil.

The peroxide bleaching of cotton goods is particularly adaptable to continuous bleaching machinery because it is comparatively easy to maintain accurate control of all the peroxide bleaching chemicals. We do not know exactly what the possibilities of machinery designed for just such work can be, because there are no such machines at the present time. The nearest approach to continuous peroxide bleaching, today, is in running four or five slack washers in series, with a jay box between each two, at about sixty yards per minute. Such an arrangement has been used with a fair amount of success, but the production is small and the cost is high.

It is quite likely that, when a suitable machine of the continuous type, handling cloth either in the full width or in rope form, is put into operation with a properly worked out peroxide bleaching process, the results, both in quality and in costs, will be exceptionally satisfactory.

Cotton goods that require a bleached bottom that is absolutely level and uniform, will then be done in such a machine. This includes almost all of the cotton fabrics that are causing the most trouble now in high speed fast color dyeing.

Colored yarn goods such as shirtings and curtain materials, will also probably be done on continuous bleaching machines, because these machines will reduce the tendency of such goods to mark off.

The important factors of peroxide bleaching in continuous bleaching machinery will be:

1—The selection of bleaching chemicals, that is, peroxide, alkalies and oils, which can be put under semi-automatic control. If this is not done, it may be necessary to have highly skilled operatives for the bleaching machines, which will bring up the operating costs.

2—The construction of apparatus for making continuous additions of the bleaching chemicals to the various liquors.

3—The developing of chemical or electrochemical methods and apparatus which will allow accurate determinations of all the bleaching chemicals in much less time than such determinations now require.

Determination of Active Chlorine in Hypochlorite Liquors

By **J. D. BLAKELEY, J. M. PRESTON and F. SCHOLEFIELD**

THE complete analysis of a commercial hypochlorite solution is a complicated matter, involving the determination of hypochlorite, chlorate, chlorite, and chloride, together with the alkalinity due to hydroxide and carbonate, or the acidity due to decomposition of the hypochlorite.

For most purposes, however, a determination of the hypochlorite content is sufficient, and for this a number of methods are available; the oldest being that of Gay-Lussac (annales de Chimie et de Physique [2], 1824, 26, 162) who titrated a solution of arsenious acid, colored by means of Indigo sulphonate, with the hypochlorite solution in the presence of hydrochloric acid, the end-point being recognized by the disappearance of the blue color of the Indigo sulphonate. Lunge (Untersuchungsmethoden, 1910, 1, 591) later pointed out that the results given by this method are too high, since in acid solution any chlorate present will also oxidize arsenious acid. The method was slightly modified by Kurtz (J. Pharm., 1826; Dingler's polyt, J., 1826, 263) who used as indicator a mixture of iodine, crystallized sodium carbonate, and potato starch, while Denigés (J.C.S., 1891, 60, 615) replaced the original Indigo sulphonate by potassium bromide, titrating to the appearance of the yellow color of free bromine. It is found, however, that in dilute solutions chlorine and arsenious acid can exist side by side, so that the bleaching of Indigo sulphonate in Gay-Lussac's method is no indication that all the arsenious acid has been oxidized. This is supported by the observation that the results vary considerably with the dilution and also with the amount of acid present.

About 30 years later Penot (J. pr. Chem. [1], 1851, 54, 59) suggested titrating with arsenious acid in bicarbonate solution, using starch-potassium iodide paper as external indicator. This method is simple and accurate, and is still the standard method for the estimation of hypochlorite solutions. If desired, a solution of starch-potassium iodide may be used as internal indicator near the end-point, but this should not be added too early or inaccurate results are obtained due to the formation of iodine chloride.

The Penot method was followed by one devised by Bunsen (Annalen, 1853, 86, 265), involving the addition of potassium iodide, and the titration of the liberated iodine, in acetic acid solution, by means of sodium thiosulphate. The titration should be as rapid as possible to avoid loss of chlorine, and a large excess of acid should be avoided. In the Bunsen method, and to a smaller extent in the Penot method, a disturbing effect often occurs due to the reappearance of the blue color of the starchiodine compound. Schultz (Z. angew Chem., 1903, 16, 833) found that this happens frequently in the estimation of

excess hypochlorite in disinfected waste liquors, and ascribed it to the presence of oxidizing substances, e.g. ferric oxide and calcium chlorate.

Pontius (Chem. Ztg., 1904, 28, 59) devised a method involving titration with potassium iodide in the presence of a fairly large excess of sodium bicarbonate

$$3CaOCl\ (=6Cl) + 6NaHCO_3 + KI = KIO_3 + 3CaCO_3 + 6NaCl + 3CO_2 + 3H_2O$$

At the end-point the excess potassium iodide reacts with potassium iodate according to the following ionic equation

$$IO'_3 + 5I' + 6\dot{H} \longrightarrow 3H_2O + 3I_2$$

Starch solution is added at the beginning of the titration, which should be carried out rapidly to avoid any action between the hypochlorite and the starch.

A further method was described recently by A. Ehrenfried (Textilber., 1929, 10, 801). A measured volume (in excess) of arsenious acid solution is added to the sample of hypochlorite, and the excess is estimated by titration, in acid solution, with potassium bromate solution. The indicator used is Methyl Orange, the color of which is bleached by the free bromine liberated at the end-point.

Reaction—

$$2NaOCl + As_2O_3 = 2NaCl + As_2O_5$$

The excess arsenious acid is estimated by titration with potassium bromate in the presence of hydrochloric acid

$$3As_2O_3 + 2KBrO_3\ 2HCl = 2KCl + 2HBr + {}_3As_2O_5$$

At the end-point free bromine is liberated—

$$KBrO_3 + 5HBr + HCl = KCl + 3H_2O + 3Br_2$$

A comparison of the methods of Penot and of Bunsen with the bromate method shows that the second and third give results which are definitely higher than those given by Penot's method, since they include also the oxidizing effect due to traces of chlorate, chlorite, bromate, and iodate which may be present simultaneously with the hypochlorite.

A sample of electrolytic sodium hypochlorite was titrated according to each of these three methods—

(1) *Penot Method*—10 c.c. hypochlorite liquor required 15-70 c.c. *N*/10 sodium arsenite (f = 1.006)

= 5.600 g. available chlorine per l.

(2) *Bunsen Method*—10 c.c. hypochlorite liquor required 15.73 c.c. *N*/10 sodium thiosulphate (f = 1.011)

= 5.639 g. available chlorine per l.

(3) *Bromate Method*—10 c.c. hypochlorite liquor. Added 25 c.c. *N*/10 sodium arsenite (f = 1.006). Excess required 9.10 c.c. *N*/10 potassium bromate (f = 1.018)

= 5.634 g. available chlorine per l.

In every case the results of methods 2 and 3 were in good agreement.

The disadvantages attendant on the use of the ordinary indicators can be eliminated entirely if electrometric methods are employed. These give excellent end-points and are ideal methods for routine analysis.

If a plain platinum wire be immersed in a solution containing free ions an "electrode potential" is established, the value of which depends on the nature and concentration of the ions in the solution. In the case of chlorine, this electrode potential is unusually high (about 1.40 volts against the hydrogen electrode), so that it is comparatively easy to observe the point at which all free chlorine is removed from the solution.

For the measurement of electrode potentials the solution to be measured is combined with a standard "half cell," which may conveniently be a standard calomel electrode. The combination then forms a complete electrical cell, the E.M.F. of which can be measured by a potentiometer, the system being shown in Fig. 1.

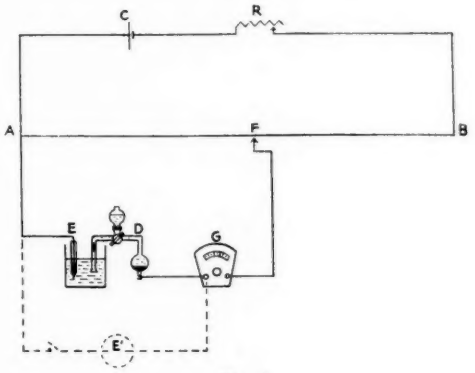


Fig. 1

AB=Potentiometer wire
C=2-Volt accumulator
R=Variable resistance
E=Platinum electrode
D=Calomel electrode
G=Galvanometer
E'=Standard cell
F=Sliding contact

The straight wire potentiometer AB, 100 cm. long, was calibrated before each experiment to read directly in millivolts, by means of a standard Weston cell E^1 used in conjunction with the variable resistance R. The platinum wire electrode E consists of a small piece of stout platinum wire fused into the end of a narrow glass tube containing mercury as contact medium. The galvanometer G was of the ordinary type made by W. G. Pye & Co. and was found to be sufficiently sensitive for all requirements. The standard calomel electrode was of the shape shown, having a bent tube leading into the titration vessel, the end of which was sealed by a sintered glass plate. The electrode proper consists of a platinum wire in contact with a layer of mercury and calomel, the remainder of the bulb and tube being filled with saturated potassium chloride solution supplied from the reservoir shown.

The cell E is so arranged that the positive electrode (plain platinum) is in opposition to the positive terminal of the accumulator C, and the E.M.F. of the cell is then measured by sliding the contact F along the wire until no deflection is obtained on the galvanometer, being then read off directly on the potentiometer scale.

(1) *Penot Method*—Sodium arsenite solution is added in small portions to the hypochlorite solution, the E.M.F. of the cell being measured after each addition. To obtain good results sufficient sodium bicarbonate should be added to neutralize all the free alkali present. At the end-point a large decrease of E.M.F. occurs, due to the removal

PENOT METHOD

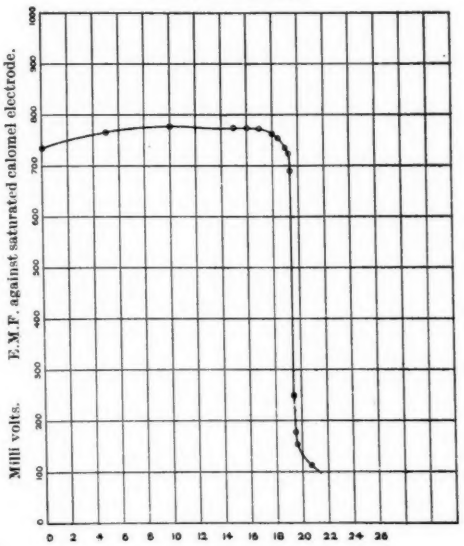


Fig. 2

of free chlorine from the solution. This is shown to advantage in the dE/dx curve, i.e., the change in potential between successive additions divided by the volume of solution added.

PENOT METHOD dE/dx CURVE

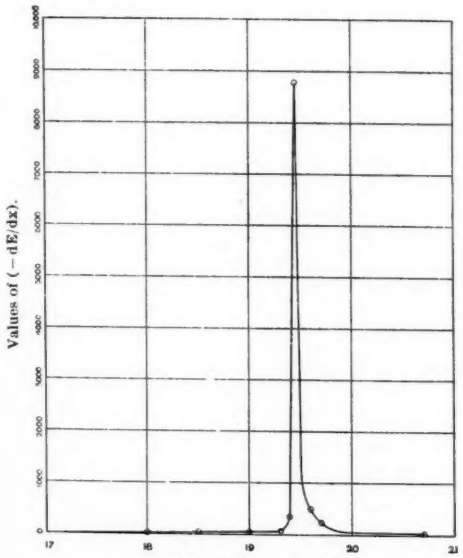


Fig. 3

Example—

Vol. of Arsenite in c.c.	E.M.F. (milli-volts) against Cal. Electrode	dE/dx
0	737	—
5	768	—
10	777	—
15	773	—
16	773	—
17	773	—
18	763	10
18.5	755	16
19.0	736	38
19.30	723	43
19.40	691	320
19.45	250	8820
19.60	177	487
19.70	155	220
20.70	112	43

(2) *Bromate Method*—Since, at the end-point, free bromine is liberated, the curve obtained is the reverse of that for the Penot method, i.e., in this case a sudden increase of potential is obtained. The titration solution is made up exactly as described previously—by adding a measured volume (in excess) of sodium arsenite solution and then about 15 c.c. of concentrated hydrochloric acid. As the acid used may contain some free chlorine, it is advisable to estimate a "blank" solution alongside, for very accurate titrations.

BROMATE METHOD

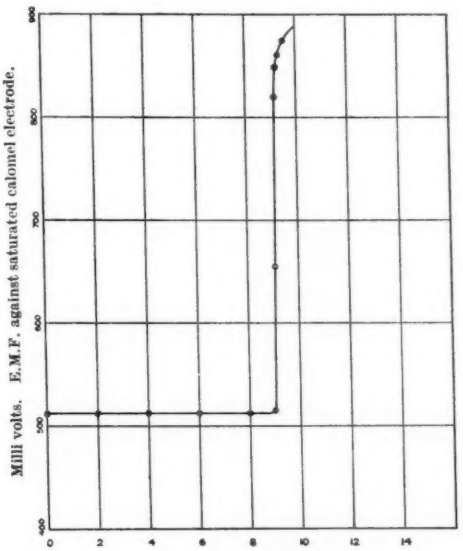


Fig. 4

Example—20 c.c. hypochlorite solution (2.8 g. available chlorine per l.). Added 25 c.c. $N/10$ sodium arsenite and 15 c.c. concentrated hydrochloric acid.

Vol. of Bromate in c.c	E.M.F. milli-volts	dE/dx
0	512	—
2.0	512	—
4.0	512	—
6.0	512	—
8.0	512	—
9.0	514	2.0
9.10	654.5	1405
9.15	821	3330
9.20	849	560

9.30	...	861	...	120
9.50	...	875	...	70

N.B.—The electrometric end-point coincides exactly with the appearance of the yellow color of free bromine.

The above two methods can conveniently be combined together to estimate both the hypochlorite and the chlorate content of a bleaching solution, by titrating first with sodium arsenite in bicarbonate solution, then adding a known excess of arsenite, acidifying with hydrochloric acid, and back titrating with potassium bromate. The difference between the two results will give the chlorate content of the sample.

For a works routine analysis both these methods can be simplified so as to eliminate the necessity for a potentiometer, standard cell, accumulator, etc. Since the change in potential at the end-point is so marked, it is easy to construct a buffer solution of potential intermediate between the extreme limits of the change.

BROMATE METHOD dE/dx CURVE

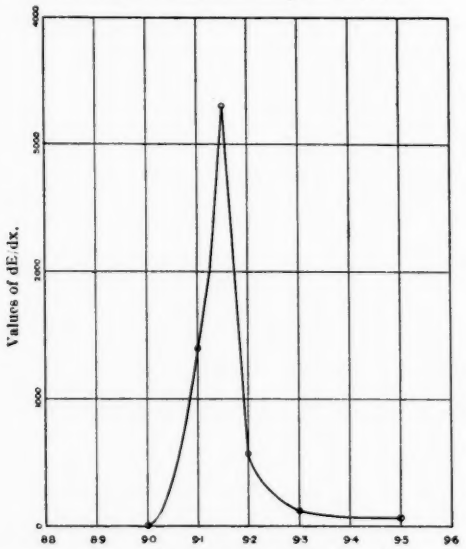


Fig. 5

This buffer is combined with the solution to be titrated by means of a H bridge containing saturated potassium chloride solution. The lower ends of the H bridge are drawn out to capillary dimensions and are then closed by plugs of agar-agar jelly, gelatin containing potassium chloride, or even by small rolls of filter paper. The top ends of the bridge may be connected by a piece of rubber tubing to prevent spilling of the solution.

A platinum electrode, with a mercury seal, is immersed in each solution, and by means of copper wire dipping into the mercury, the electrodes are connected in series with a null-point galvanometer and a tapping key.

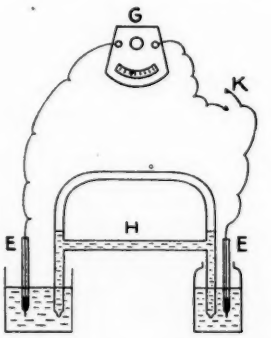
At the end-point a complete reversal of the direction of the current will be obtained, with a corresponding change in the direction of deflection of the galvanometer needle.

The buffer solution is best kept in a 4 oz. glass bottle fitted with a rubber stopper through which pass one electrode and a short piece of wide glass tube to receive one limb of the H bridge.

The titration solution is added in small portions with stirring, depressing the key K after each addition, until a complete change over in the direction of deflection of the galvanometer needle is obtained.

(1) *Penot Method*—The change of E.M.F. obtained was from 691 milli-volts to 250 milli-volts, and this offers a wide choice of buffer solutions. Treadwell (Helv. Chim. Acta, 1921, 4, 396) recommends $N/100$ iodine solution containing iodide, Schleicher and Toussaint (Z. Anal. Chem., 1925, 65, 399, 406) used dilute hydrogen peroxide or $M/5$ potassium dichromate, but equally good results have been obtained with $M/5$ potassium dihydrogen phosphate, and with $M/5$ potassium dihydrogen phthalate. At the end-point, using a Pye galvanometer, the change over was of the order of 30 to 40 scale divisions, and the results were in good agreement with both the potentiometric and the ordinary indicator methods.

(2) *Bromate Method*—We are here concerned with an increase of E.M.F. from 512 milli-volts to about 820 milli-volts and so can again make use of the iodine-iodide buffer used in the Penot method. A better one, however, is that described by Callan and Horrobin (J.S.C.I., 1928, 48, 329T)—10 c.c. of concentrated hydrochloric acid and 10 c.c. of 20% potassium bromide solution are diluted to 100 c.c. with distilled water, and one or two



E=Platinum electrode

E=Platinum electrode in buffer solution (compensation electrode).

H= H bridge filled with saturated KCl solution

G=Galvanometer

K=Tapping key

Fig. 6

drops of $N/10$ potassium bromate solution are added until a faint, but distinct, reaction to starch-iodide paper is obtained. This buffer deteriorates slightly on standing, but may be restored by the addition of a further one or two drops of bromate until it again gives a faint blue color with starch-iodide paper. Good results are again obtained and the end-point is remarkably sharp.

In the paper referred to above Treadwell investigated electrometric titrations by the Pontius method, and found that such titrations were practicable in bicarbonate medium—using a carbonate-bicarbonate buffer solution, the bicarbonate being in fairly large excess. The reaction, however, is very slow towards the end-point and the results do not agree exactly with those obtained by the original Pontius method.—*Journal Society of Dyers and Colorists.*

Dyers' Accounts, V

Presenting a Balance Sheet—The Accounts of Partners

By **S. HOWARD WITHEY, F.C.I.**

THE items remaining on the trial balance after the periodical trading and profit and loss account has been prepared represent the book value of the various assets which are employed in the business for profit-earning purposes, and the amount of the different liabilities, the former being debit balances, and the latter credit balances. These items have to be summarized in the form of a balance sheet which should exhibit a true and correct view of the state of affairs on a given date.

Although there is no standard or uniform method of presenting a balance sheet, the assets of the dyeing concern are usually enumerated in the order of their convertibility, that is to say, with reference to the readiness with which they could be converted into actual cash, if such a course was found to be necessary or desirable. The following list shows the correct order of convertibility:

Cash Items

Cash in hand, corresponding with the debit balance of the "cash" columns of the general cash book, and with the actual contents of the cash box, etc.

Cash at bank, corresponding with the debit balance of the "bank" columns of the cash book, and with the pass book balance, subject to cheques paid away by the dyer and not yet presented at the bank for payment by the payees.

Cash which has been advanced by the dyer, and which is returnable on demand or at very short notice.

Securities and investments of a gilt-edged nature.

Any other assets which could be turned into cash almost at once.

Bills receivable, being the total value of bills of exchange which have been drawn by the dyer, accepted by the debtors, but not yet met.

Book debts, consisting of amounts owing by customers and debtors, and representing the total debit balances of the personal accounts kept in the sales' or customers' ledger.

Shares held by the dyer.

Stock on hand, including the value of the work in progress.

Any other assets which could be realized at short notice.

Transport means used for business purposes, including vans, cycle-cars, and so on.

Machinery and plant.

Business premises, including freehold and leasehold land.

Tools, implements and appliances.

Shares held by the dyer for the purpose of securing business as distinct from investments.

Furniture, fixtures and fittings.

Any assets which are unrealizable except with the business as a going concern.

The book value of the business's goodwill.

Any amounts which have been capitalized by the dyer for the time being, but which will eventually have to be charged against the profits.

Losses in other directions.

The best order for the liabilities is: (a) Bank overdraft; (b) bills payable; (c) trade creditors; (d) accrued expenses; (e) loans; (f) reserves; (g) capital of the dyer or the separate capitals of the partners.

In the case of the business which has already been converted into a limited liability company, the liabilities and the assets should be shown on the balance sheet in the following order, where applicable:

LIABILITIES

Nominal or Authorized Capital.
Issued or Paid-up Capital.
Debentures.
Mortgages.
Amount Due to Bankers.
Bills Payable.
Creditors.
Reserves, etc.
Balance of Profit and Loss.

ASSETS

Business Premises, including Land.
Furniture, Fixtures and Fittings.
Machinery and Plant.
Tools, Implements and Appliances.
Motor or other Transport Means.
Stock, including incompleted contracts.
Material on Consignment.
Book Debts.
Bills Receivable.
Cash at Bank.
Cash in Hand, including Petty Cash.

Investments.
Goodwill.
Preliminary Expenses.

Calculating Depreciation

Each wasting asset employed should be subjected to an adequate deduction to cover depreciation resulting from constant use, actual obsolescence, or the lapse of time, and in this connection there are four principal methods of determining the depreciation, each method having its own peculiar advantages when applied in specific instances. They are as under:

Method No. 1.—An equal proportion of the first or original cost of the asset may be written off each year, so that at the end of a definite period, estimated to represent the effective life of the asset as a profit-earning factor, the book value will automatically be reduced to nil.

Method No. 2.—A fixed percentage of the first or original cost of the asset may be written off the gradually diminishing book value of the asset, so that at the end of a certain period the debit balance of the asset account will represent a purely nominal or break-up value.

Method No. 3.—The debit balance shown in the asset account at the commencement of each financial year or accounting period may be increased by the addition of interest at a definite rate per cent. per annum, and the cost of the asset (including interest) spread evenly over a certain period.

Method No. 4.—The asset may be subjected to a revaluation by an acknowledged expert, and the ascertained shrinkage in value charged against the periodical profits in one amount.

Whichever method is adopted, the amount representing the depreciation should be recorded on the credit side of the particular asset account, and also on the debit side of a depreciation account, the final balance of the latter being transferred to profit and loss, and when drafting the balance sheet the sums written off should be shown as deductions from the different assets as enumerated on the assets side.

The balance of net profit shown in the periodical profit and loss account of the one-man business may either be withdrawn from the business for the dyer's private purposes when required, or retained as additional working capital, whereas the net profit of the firm consisting of two or more partners will have to be divided in accordance with the deeds or other agreements which have been entered into. Considerable adjustments will most likely have to be made in the accounts of partners at balancing time, and unless these adjustments are effected in a proper manner, the rights of the partners will not be fairly settled.

Dealing with Salaries

In many instances, some of the partners are paid a certain salary in consideration of their whole-time services on behalf of the firm. Where this is so, the amount paid out may be posted from the cash book to the debit side of the salaries account, kept in the nominal or expenses ledger, the final balance of this account being transferred to the debit side of the periodical profit and loss account. The same applies to the salary paid to a junior partner who has little or no capital invested in the business, the salary being charged against the profits before arriving at the balance to be shared. Instead of paying out a partner's salary in actual cash, the amount agreed upon may be debited to the salaries account and credited to the partner's capital account.

If the amount of each partner's capital has been definitely determined, the individual capital accounts should remain unaltered during the term of the partnership. The salaries, shares of profits, and interest on capital of the partners would then have to be recorded in separate drawing or current accounts, the original capital and the balance of profit of each partner being then quite distinct. In those cases where the profits are shared in the same proportion as the amount of capital invested by each partner, it will not be necessary to credit the partners with interest on capital, as the following example will prove:

A and B are partners in a dyeing business, A's capital being £1,000 and B's capital £500. In sharing the profits they agree that A shall have 2/3rds and B, 1/3rd. The audited profit and loss account for the year ended March 31, 1930, showed a credit balance of £660 representing the amount of net profit realized. Ignoring interest on capital, the adjustments to be made in the books of account to give effect to these results would take the form shown in Table 1.

TABLE I

Dr. — A's Capital Account — *Cr.*

1930		£	s.	d.	1929		£	s.	d.
Mar. 31	To Balance c/d.....	1,440	0	0	Mar. 31	By Balance c/d.....	1,000	0	0
					1930				
					Mar. 31	By 2/3rds of £660.....	440	0	0
		1,440	0	0			1,440	0	0
					1930				
					Mar. 31	By Balance c/d.....	1,440	0	0

Dr.	B's Capital Account				*Cr.*		
1930		£	s. d.	1929		£	s. d.
Mar. 31	To Balance.....	720	0 0	Mar. 31	By Balance c/d.....	500	0 0
				1930			
				Mar. 31	By 1/3rd of £660.....	220	0 0
		720	0 0			720	0 0
				1930			
				Mar. 31	By Balance c/d.....	720	0 0

If, instead of ignoring interest on capital, it had been agreed to credit each partner with interest at the rate of 5 per cent. per annum, the necessary adjustments would be effected on the lines indicated in Table 2.

It will be seen that when the profits are shared in precisely the same ratio as the amount of capital invested in the business, the crediting of interest on capital to each partner's capital account would give the same results as when interest is ignored, the total amount of the interest being, of necessity, deducted from the balance of profit before arriving at the sum to be shared. But if the share of profits bears no relationship to the invested capital, it is absolutely necessary to credit each partner with interest, if an equitable adjustment of the partnership rights is to be effected. The following example will make this clear:

TABLE 2

Dr.	A's Capital Account				*Cr.*		
1930		£	s. d.	1929		£	s. d.
Mar. 31	To Balance c/d.....	1,440	0 0	Mar. 31	By Balance c/d.....	1,000	0 0
				1930			
				Mar. 31	By 5% Interest.....	50	0 0
				Mar. 31	By 2/3rds of £585.....	390	0 0
		1,440	0 0			1,440	0 0
				1930			
				Mar. 31	By Balance c/d.....	1,440	0 0

Dr.	B's Capital Account				*Cr.*		
1930		£	s. d.	1929		£	s. d.
Mar. 31	To Balance c/d.....	720	0 0	Mar. 31	By Balance c/d.....	500	0 0
				1930			
				Mar. 31	By 5% Interest.....	25	0 0
				Mar. 31	By 1/3rd of £585.....	195	0 0
		720	0 0			720	0 0
				1930			
				Mar. 31	By Balance c/d.....	720	0 0

C and D are partners, trading as C, D and Co., C's capital being £2,000 and D's capital, £500. They agree to share profits equally, and for the financial year ended April 30, 1930, a net profit of £1,000 is made. If interest on capital is not provided for, the capital accounts would appear as in Table 3, after making the adjustments.

In the above example, the consequence of ignoring interest would be that D would benefit to the extent of £37 10s., at the expense of his partner C, and the general conclusion to be drawn is that when the profits are shared without relation to capital invested, each partner should be credited with interest at an agreed rate per cent per annum, and the total amount of such interest charged against the profits.

TABLE 3

Dr.	C's Capital Account					*Cr.*		
1930		£	s.	d.	1929		£	s.	d.
Apr. 30	To Balance c/d.....	2,500	0	0	Apr. 30	By Balance c/d.....	2,000	0	0
					1930				
					Apr. 30	By ½ share of £1,000.....	500	0	0
		2,500	0	0	1930		2,500	0	0
					Apr. 30	By Balance c/d.....	2,500	0	0

Dr.	D's Capital Account					*Cr.*		
1930		£	s.	d.	1929		£	s.	d.
Apr. 30	To Balance c/d.....	1,000	0	0	Apr. 30	By Balance c/d.....	500	0	0
					1930				
					Apr. 30	By ½ share of £1,000....	500	0	0
		1,000	0	0			1,000	0	0
					1930				
					Apr. 30	By Balance c/d.....	1,000	0	0

By providing for interest on capital, however, the result would be as follows:

Dr.	C's Capital Account					*Cr.*		
1930		£	s.	d.	1929		£	s.	d.
Apr. 30	To Balance c/d.....	2,537	10	0	Apr. 30	By Balance c/d.....	2,000	0	0
					1930				
					Apr. 30	By 5% Interest.....	100	0	0
					Apr. 30	By ½ share of £875.....	437	10	0
		2,537	10	0			2,537	10	0
					1930				
					Apr. 30	By Balance c/d.....	2,537	10	0

Dr.	D's Capital Account					*Cr.*		
1930		£	s.	d.	1929		£	s.	d.
Apr. 30	To Balance c/d.....	962	10	0	Apr. 30	By Balance c/d.....	500	0	0
					1930				
					Apr. 30	By 5% Interest.....	25	0	0
					Apr. 30	By ½ share of £875.....	437	10	0
		962	10	0			962	10	0
					1930				
					Apr. 30	By Balance c/d.....	962	10	0

—Dyer & Calico Printer.

AMERICAN DYESTUFF REPORTER

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THE NEW COLORSCOPE

THE new Colorscope is an instrument invented by Dr. H. H. Sheldon of New York University, and his assistant, Dr. W. A. Schneider of the same university. It was designed primarily for the matching of two colors to a degree much closer than is possible with the eye alone. Its principle of operation is based on the photo-electric cell, which is already well known for its extensive applications in the control of sensitive apparatus. The theory and operation of this apparatus is to be described in full by Dr. Sheldon at a future meeting of the American Association of Textile Chemists and Colorists. The claims made for the instrument are as follows:

1. Regardless of light used, it shows how one sample differs from another with respect to shade.
2. It indicates what colors should be added to grey goods to make them equal a given sample; in many instances in terms of the actual dyes used.
3. It shows how two colors differ, and indicates the change to be made to make sample 1 equal sample 2.
4. It eliminates sheen, weave and texture variations completely by the use of an integrating sphere and rotation of the samples.
5. It does not analyze or produce spectrograms.

Whether or not this Colorscope can successfully uphold all the claims made for it when it is put to use in the industry, is of course to be demonstrated. However, it does promise much in the way of making color matching as much of a science as is the rest of a dyer's work.

Matching colors until the present time has been, broadly speaking, an art, and an art calling for almost superhuman expertness. A dyer might obtain what he thought was a match; but many other dyers might disagree with him. So far there has been no way of proving that a match was correct. Departing from a consideration of simple matches, and considering the matching of shades on different materials; quite evidently there will be differences of weave, thread patterns, sheen, etc. Formerly a match of this kind had to be approximated. If the Colorscope can match samples in that class satisfactorily, it will prove immensely valuable on that score alone.

To show the need of an instrument such as the Colorscope, designed to show definitely whether or not a match is correct regardless of sheen, weave, etc., an incident may be recalled: A laboratory assistant, obtaining what he considered to be a match, showed it to the boss who was an expert. The match was called off shade. After having this procedure repeated several times, the assistant, out of curiosity, took a piece of the cloth on which he had been experimenting and substituted it for the sample. He then showed the two pieces to his superior who immediately said they were not alike. In this case the assistant could not be blamed for throwing up his job in disgust; and on the other hand, the boss scarcely could be blamed, for it is well known that two samples, although really the same color and shade, appear to be different when they are not the same size.

Any instrument, even though it should only register an advance in solving such problems, would be a real contribution to the dyeing industry. Should the Colorscope uphold in practice only a part of what it has done experimentally, it will remain a big step in the right direction.

THE AMERICAN CHEMICAL SOCIETY

THE American Chemical Society deserves congratulations for the work it has done; its record during these last twenty-five years is impressive. Figures can tell only part of the story, but, in this case, they clearly indicate the extent of accomplishment. From 1906 to the last published report, the annual income from the Secretary's collections increased by $289,626. In the same period of time the advertising net revenue increased nearly $100,000, and the membership increase during the period has been nearly 15,000. In 1906, there was expended on the society's publications $20,492; the most recent annual expenditure for publications was $557,525. The society's surplus funds have increased by about $294,000, and in addition the society has trust funds amounting to $183,851.

The following tabulation referring to organizations of a similar character is of special interest.

Society	Subscription and Membership Fee	Published Matter Sent to Members per Dollar
American Chemical Society...	$15.00	600,000 words.
Chemical Society (London)...	33.94	134,000 "
Society of Chemical Industry..	24.40	200,000 "

Deutschen Chemischen Gesellschaft	30.00	250,000	"
Verein Deutscher Chemiker	9.00	270,000	"
Deutsche Bunsen Gesellschaft	7.50	100,000	"
Societe Chimique de France	5.00	300,000	"
Societe de Chimie Industrielle	10.00	259,000	"
Societe Suisse de Chimie	4.00	142,000	"

The American Chemical Society's success may be attributed to three things: first, its resolve that its primary object should be to serve the American chemical industry; second, its belief that by serving the industry loyally in an unselfish manner, the industry in return would see that the society was adequately supported; and finally, the vitality and efficiency of the society's own organization. Surely, it is an organization which has a work worth doing, and succeeds in doing it well.

EXTRACTORIALS

In the realm of business there are those who are thoughtless and those who are careless and those who would but cannot. The latter will eventually succeed and then contribute their share of support to the progressive movements of the industry in which they are engaged, but the thoughtless and the careless are the ones who make the burden heavy on those who freely support the cause of the leaders. The thoughtless and the careless have not yet awakened to the responsibilities that rest on them. Then there are the skeptics—a more or less self-satisfied class who are content with the present and feel safe in letting the future take care of itself. It is, and ever has been, the thoughtless, the careless and the skeptics who have hindered progress. This is the class on which the united efforts of the progressive must be turned.—*Nat'l Laundry Journal.*

Even the highest quality goods have a price limit, at any rate as far as the manufacturer is concerned, though at times it would seem as if making-up expenses and general distribution charges were somewhat disportionate compared with the costs of finished fabrics as delivered from mill or warehouse. But with the great majority of textiles price is so important a factor that keen economic oversight must be exercised at each and every stage of production, so that it has been well said that a dyer must not only match to shade and requisite fastness, but also he must "match to price."—*Textile Argus.*

A story has been going the rounds about Joe Turner of Joseph Turner & Company which is almost too good to be true. It seems that one of his younger contemporaries among the chemical distributors asked Mr. Turner to reveal the inner secrets of his success. The answer is reported to have been: "In my youth I formed the habit of buying my straw hat in August." This wise and cryptic advice must be allegoric.—*Chemical Markets.*

No man knows when he will find his business obsolete. No man can predict that, in twelve months from now, he will have the flourishing business he has today, because of the ever-present dangers of obsolescence. The patent office it should be noted is issuing eighty thousand patents a year.—*Champe S. Andrews in Executives Service Bulletin.*

Employers must also remember that these older men and women are heads of families, and that the purchasing power of the family depends upon the earnings of these older workers. If the family is unable to purchase the products manufactured by the employer, the employer loses a market.—*United States Daily.*

A business merely in search of an average volume may decay. Big men proclaim the arrival of a period summoning the survival of the astute. Recent price cuts and actions by giant corporations prove Size in Business is not a protection—a guarantee.—*Joseph Wild in Daily News Record.*

The largest nitrogen fixation plant in the western hemisphere, which greatly increases the industrial and military independence of the United States, was described by Prof. Lauren B. Hitchcock, of the University of Virginia, before the American Chemical Society at Atlanta. This plant converts daily 350 tons of inert nitrogen gas of the atmosphere into sodium nitrate and anhydrous ammonia for peace-time industrial uses. But if the United States were at war, the plant would largely free her of the necessity of getting Chile saltpeter from South America for fertilizer, explosives, and essential chemical industries. The plant is a splendid example of the application of recent refinements in process. Application of the latest technology is necessary in order that the synthetic material may compete with the Chile product dug from the surface of the ground. It is located at Hopewell, Virginia, on the James River, 80 miles from Hampton Roads.—*Science Service.*

The most remarkable feature about advertising probably is the fact that it is most remunerative in periods of depression, as Mr. Hill's report indicates. Beyond this, advertising in "hard times" exercises a psychological influence which goes far toward relieving any general feeling of gloom. The wise man advertises in dull times, as well as in periods of prosperity.—*Manufacturers Record.*

Don't wait for the other fellow to come to you; go to him.

In competition with others, always give them the credit for being a little smarter than you are. Then work like the deuce to prove that they aren't.—*George Churchill, Cleaners & Dyers Review.*

High Temperatures and Textiles

By **GEORGE H. JOHNSON**

Director, Research Department, Laundryowners Nat'l Ass'n

SINCE comparatively high temperatures are used in power-laundry practice for pressing and ironing damp garments and pieces of flat work, it is essential that some thought be given to the effect of elevated temperatures upon fibers. Experience has indicated that a large number of variables enter into the problem of scorching. Instead of there being a definite scorching temperature, experience has shown that there are an entire series of such temperatures, depending upon the interrelation between the temperature used and the length of exposure. Thus it has been found that the development of scorch or, in the case of cellulose-acetate fibers, of fusing and brittleness is the result of a number of factors, including the following:

1. The intensity factor or the degree of heat applied, all of which can be measured by the temperature of the ironing surface.
2. The time factor or the duration of contact between the material that is being pressed and the source of the heat.
3. The moisture content or condition of the pieces that are being ironed or pressed.
4. The padding of the ironing surface.
5. The training and the general efficiency of the operator with especial regard to the speed of ironing and the pressure that is exerted.

The Scorching Temperatures of Wool

The above general observations are borne out by a number of investigators.

Clark, when studying the scorching temperatures of wool, obtained the following results:[1]

TABLE I.

Time of Contact Producing Scorching on White Wool Flannel

Temperature of iron	Time of Contact in Seconds			
	30	45	60	75
300° F.	None	None	None	None
310° F.	None	None	None	None
320° F.	None	None	None	None
330° F.	None	None	None	Slight
340° F.	None	None	Slight	Slight
350° F.	None	Slight	Much	Much

Clark concluded from his studies that a pressing temperature of 330° to 340° F. is the danger point as far as the finishing of wool is concerned, but agrees that the avoidance of scorch is largely dependent upon the dexterity and speed of the operator plus the cooling effect that the moisture held by the damp material has upon the fabric that is being pressed.

The Comparative Effect of Dry and Moist Elevated Temperatures

Shupp[2] reports his observations when determining the effect of high temperatures upon wool and silk as compared with cotton. Laboratory tests were conducted at temperatures of 231° and 329° F. respectively. Dry samples were placed in an electric oven at 231° F. It was found that after 15 minutes exposure, white silk began to acquire a pale yellow color, whereas, the wool and cotton samples remained unaffected. These observations indicate that silk fabrics must be dried very carefully or they will be discolored at elevated drying and ironing temperatures, although here again it must be recalled that the presence of moisture in the silk pieces that are being pressed logically will tend to cool the hot ironing surface. They furthermore indicate that when silk pieces are dried in a dry-room or in a tumbler, the temperature should not be much above 212° F. while the time of drying should be reduced to a minimum. Shupp observed further that when the silk garments are dried and ironed on a press, the gauge pressure should not greatly exceed 90 pounds per square inch and the operator should be instructed to remove the fabric from the press as soon as possible.

A further series of tests were conducted by the same investigator to determine the effect of continuous ironing on fabrics. Two sets of samples of cotton, wool and silk were exposed to elevated temperatures for long periods of time. One set was exposed to the action of high temperatures of being placed beneath the flap of the outer covering cloth on the upper roll of a flatwork ironer for 46½ hours. The ironer was heated by steam at a gauge pressure of 100 pounds per square inch. Just what gauge steam pressure in pounds per square inch means in degrees Fahrenheit is shown in Table II.

1. *Cleaning and Dyeing World, November,* 1928, *p.* 38.
2. *L.N.A. Bulletin, Oct. and Nov.,* 1923.

TABLE II.

Gauge Pressure in pounds per square inch	Absolute Pressure	Temperature in degrees Fahrenheit
89.3	104	330.7
91.3	106	332.0
93.3	108	333.4
95.3	110	334.8
97.3	112	336.1
99.3	114	337.4
101.3	116	338.7
103.3	118	340.0

The second set of samples was exposed for 18 hours to dry heat at a temperature of 329° F. Tensile strength tests were then conducted by Shupp to determine the losses that occurred under the two sets of heating conditions.

TABLE III.

Losses of Strength Due to Exposure to Elevated Temperatures

Fiber	46½ hours on a flatwork ironer at 338° F. Warp loss	Filling loss	Bursting Strength loss
Cotton	32.0%	30.0%	26.0%
Wool	9.3%	19.0%	20.0%
Silk	63.0%	43.0%	27.7%

	18 hours in a drying oven at 329° F. Warp loss	Filling loss	Bursting Strength loss
Cotton	39.0%	40.0%	28.0%
Wool	6.1%	gain	14.0%
Silk	53.0%	40.0%	33.9%

According to the data contained in Table III, high temperatures will reduce the tensile strength of cotton, wool and silk, if the exposure is long enough. The wool samples showed the smallest loss of strength, but the greatest amount of discoloration.

The Effect of High Dry Temperatures Upon Cotton

Clayton in his work[1] exposed samples of bleached and unbleached cotton cloth for definite time intervals of 30 seconds each and compared the loss of strength with the intensities of scorch. He proved rather conclusively that unbleached cotton cloth will withstand slightly higher temperatures than bleached material. This fact is shown very clearly when comparing Figures 1 and 2. In the case of the unbleached cotton cloth, scorch began to appear after 30 seconds exposure at 385° F. The original warp strength of 42 pounds per inch remained unchanged until after the samples had been exposed for 30 seconds to a temperature of 350° F. At that point the tensile strength began to decrease, the loss being greater as the temperature increased. In the case of the bleached sample of cotton cloth, which was of the same construction as that used for the unbleached material, the original warp strength of 53.3 pounds began to be lessened with a 30 seconds exposure at approximately 300° to 310° F. The drop in strength as the temperature was increased also was more rapid for the bleached cloth than it was for the unbleached. The two charts explain clearly why it is that it is possible to use unbleached cotton cloth longer than bleached cloth for presses and flatwork ironers. It, furthermore, is interesting to note that in the case of unbleached cotton cloth, scorch appeared at approximately the same point at which the warp strength began to decrease. Bleached cotton cloth, however, developed a considerable decrease in strength before actual scorching appeared.

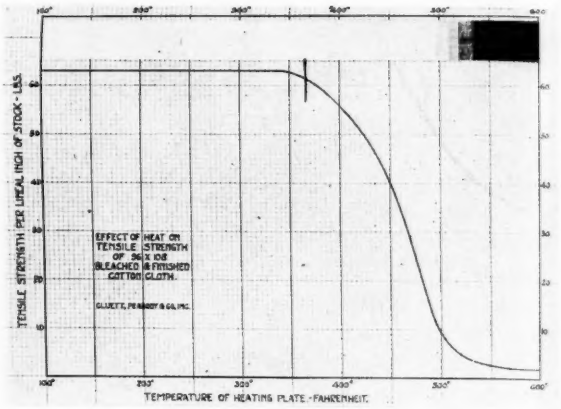

TENSILE STRENGTH PER LINEAL INCH OF STOCK - LBS.
EFFECT OF HEAT ON TENSILE STRENGTH OF 80 X 80 BLEACHED & FINISHED COTTON CLOTH.
TEMPERATURE OF HEATING PLATE - FAHRENHEIT.

Fig. 1

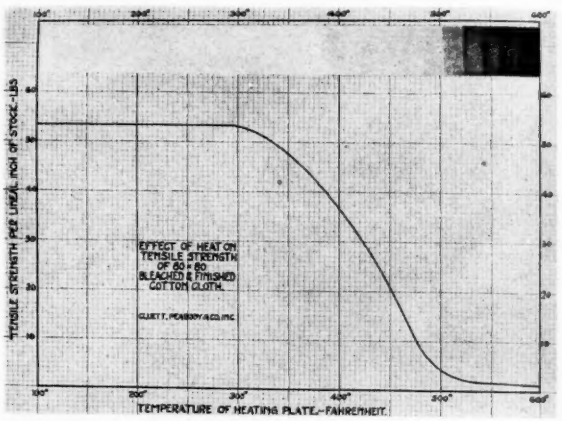

TENSILE STRENGTH PER LINEAL INCH OF STOCK - LBS.
EFFECT OF HEAT ON TENSILE STRENGTH OF 80 X 80 BLEACHED & FINISHED COTTON CLOTH.
TEMPERATURE OF HEATING PLATE - FAHRENHEIT.

Fig. 2

Just what the losses in strength that Clayton found actually amounted to are shown in Table IV, the data being taken from Figures 1 and 2.

1. *L.N.A. Year Book*, 1920, *p.* 224.

TABLE IV.

Losses of Strength after 30 Seconds Exposure to Elevated Temperatures

Temperature in degrees Fahrenheit	Unbleached Cotton Warp Strength lbs.	Unbleached Cotton Loss in Percentage	Bleached Cotton Warp Strength lbs.	Bleached Cotton Loss in Percentage
300	42.0	0.0	53.0	0.5
350	41.7	0.7	47.5	10.8
400	39.0	7.1	36.5	31.5
450	32.5	22.6	21.0	60.6
500	21.0	50.0	4.0	92.4
550	7.5	82.1	1.6	97.0
600	2.0	95.2	1.0	98.1

The original warp strength of the unbleached and bleached sample were 42 and 53.3 pounds respectively.

Figures 3 and 4 further substantiate the conclusions drawn by Clayton. In these instances tests were conducted with finer fabrics. The original warp strength of 55.5 pounds was maintained until the 30-second exposure occurred at 350° to 360° F., at which point the strength began to decrease gradually until a temperature of 450° was reached. From that point on, the decrease in strength was rapid. In the case of the bleached material, the warp strength began to diminish at a temperature of approximately 340° F. Scorching did not become pronounced until 400° F. was reached.

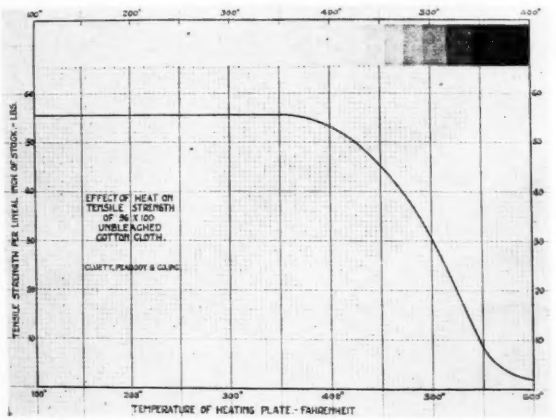

EFFECT OF HEAT ON TENSILE STRENGTH OF 36 X 100 UNBLEACHED COTTON CLOTH.
CLIETT, PEABODY & CO.INC.
TENSILE STRENGTH PER LINEAL INCH OF STOCK - LBS.
TEMPERATURE OF HEATING PLATE - FAHRENHEIT

Fig. 3

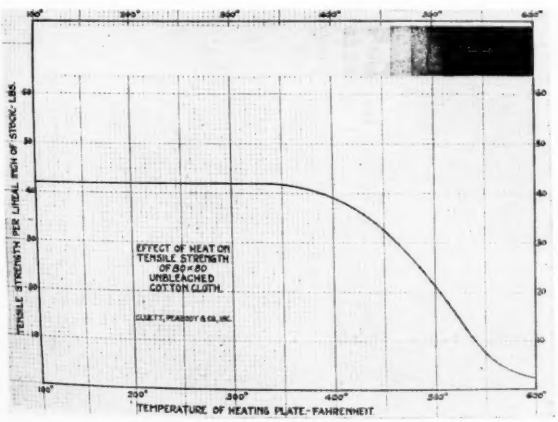

EFFECT OF HEAT ON TENSILE STRENGTH OF 60 X 60 UNBLEACHED COTTON CLOTH.
CLIETT, PEABODY & CO.INC.
TENSILE STRENGTH PER LINEAL INCH OF STOCK - LBS.
TEMPERATURE OF HEATING PLATE - FAHRENHEIT

Fig. 4

The following general conclusions may be drawn from Clayton's work:

1. The development of scorch is an indication of positive damage to cotton cloth.
2. Unbleached cotton cloth will withstand slightly higher temperatures than bleached cloth.
3. Unbleached cotton cloth developed scorch and a decrease in the strength of the material at approximately the same temperature.
4. Bleached cotton cloth developed a loss of strength at approximately 50 degrees or more below the temperature at which actual scorching was observed.
5. Unbleached cotton cloth begins to suffer a loss in strength when exposed to dry heat at a temperature of approximately 350° F.

The following table also illustrates the effect of continuous exposure of cotton to dry elevated temperatures. In these tests[1] cotton tape was used. The original strength of the tape was 49 pounds per inch.

TABLE V.

Tensile Strength of Cotton Tape after the Following Exposures

Temperature	8 Hours	16 Hours	32 Hours
230° F.	48 lbs.	47 lbs.	46 lbs.
248° F.	48 lbs.	45 lbs.	43 lbs.
266° F.	48 lbs.	45 lbs.	43 lbs.
284° F.	49 lbs.	45 lbs.	40 lbs.
302° F.	40 lbs.	36 lbs.	28 lbs.

Comparative Scorching Temperatures

Due to the many variables and factors that have a marked effect upon scorching temperatures, including the degree of moisture that is retained by the fabric, the time element, and the intensity of heat, it becomes obvious that any determination of scorching temperatures must be performer under arbitrary conditions.

Gilmore, in his work,[2] therefore decided to determine comparative scorching temperatures by placing a hot iron upon white materials containing hygroscopic moisture only and then varying both the temperatures and the time of contact. The criterion of scorching as adopted was the development of the faintest perceptible yellowing.

Just how much moisture may be present in textile fabrics that contain hygroscopic moisture only is shown in Table VI[3]. Regain is the percentage of moisture that is present in a fabric divided by the

1. *Westinghouse Electric & Mfg. Co.*
2. *L.N.A. Bulletin, Oct.*, 1928, *p.* 20.
3. *Melliand Textilberichte, No.* 9, 1928, *P.* 214.

bone-dry weight of the material. Moisture content or the hygroscopic moisture differs from regain by being the percentage of moisture present in textiles divided by the weight of the cloth plus moisture. For example, if 1000 pounds of raw silk were found to contain 99.1 pounds of water, then the hygroscopic moisture content would be 99.1 divided by 1000 or 9.91 per cent. On the other hand, when determining regain, the 99.1 pounds of moisture could first be deducted from the original 1000 pounds, giving the bone-dry weight of 900.9 pounds. Regain then would be determined by dividing 99.1 pounds of water by 900.9 pounds or the bone-dry weight, giving a figure of 11 per cent. Eleven per cent regain and 9.91 per cent hygroscopic moisture are equivalent.

The temperature at which the foregoing data was collected is not stated, but probably approximates 75° F. Relative humidity is the actual weight of vapor per cubic foot divided by the weight of vapor per cubic foot in a saturated condition at the same temperature. The higher the percentage of relative humidity or regain, the more moisture is present in air and fabric respectively.

A six-pound automatic electric iron[2] was used by Gilmore in his tests. This iron was equipped with a chromel-alumel couple that was inserted into the base of the iron through drill holes near the ironing surface. The couple was connected with a millivoltmeter, readings of which could be expressed in temperature units by reference to a calibration curve. The fabrics used were white and included the following:

1. Bleached cotton shirting that had been desized.
2. White linen dress goods, also desized.
3. Woven and knit samples of white viscose rayon.
4. Wash silk that was free from metallic weighting and sizing.

[2]*Furnished by the Westinghouse Electric & Manufacturing Company.*

TABLE VI.

TABLE OF REGAIN IN PERCENTAGE

Material	Relative Humidity in Percentage 40%	50%	60%	70%	100%
Wool—					
Raw Wool	7.2 to 9.7%	8.5 to 11.0%	9.6 to 12.2%	11.0 to 13.0%	39 to 48%
Washed Wool	11.6 to 12.3	12.5 to 13.8	13.4 to 15.0	13.9 to 16.2	32 to 38
Combed	10.8 to 12.0	11.6 to 13.0	12.5 to 13.6	13.5 to 14.0	31 to 35
Yarn	9.6 to 12.1	10.6 to 12.7	11.7 to 13.5	12.0 to 14.2	27 to 34
Silk—					
Raw Silk	5.8	6.8	7.7	8.6	26
Degummed Silk	7.9	9.2	10.5	11.9	24
Thrown Silk	5.9	6.9	7.8	8.7	25
Rayon—					
Cuprammonium	7.4	10.0	11.4	14.4	36
Viscose	7.3	9.9	11.2	14.1	35
Acetate	2.7	3.4	4.3	5.2	12
Cotton—					
American, raw	5.2 to 6.2	6.2 to 6.9	7.1 to 7.5	8.2	30
American, bleached	4.9	5.6	6.3	7.1	27
American, yarn (cops)	5.6	6.2	6.8	7.4	16
Egyptian, raw	6.4	7.3	8.2	9.0	32
Egyptian, yarn (cops)	6.0	6.6	7.3	8.0	17
Raw Cotton waste	6.2	6.9	7.5	8.2	30
Imitation Egyptian Cotton	4.0	4.8	5.6	6.4	31
Bast Fibers—					
Flax, heckled, water-retted	8.3	9.1	9.9	10.7	23
Flax, heckled, dew-retted	8.6	9.5	10.3	11.2	23
Flax, wet-spun	7.9	8.6	9.4	10.2	22
Flax, dry-spun	7.3	8.1	8.9	9.7	22
Hemp, Italian, heckled	8.7	9.4	10.1	10.8	24
Hemp, Russian, heckled	7.9	8.6	9.4	10.1	24
Jute, raw	7.9	9.2	10.4	11.6	24
Jute, yarn	8.5	9.8	11.1	12.3	34
Ramie, raw	6.6	7.2	7.9	8.4	31
Ramie, cottonized	5.1	5.7	6.3	6.9	20
Ramie, yarn	4.7	5.3	5.8	6.4	18

5. Light-weight wool flannel.
6. Celanese or cellulose-acetate samples. Included in the tests were a Celanese-natural silk mixture, a shirt, a sample of underwear material, and a piece of voile.
7. "Iron-proof" Celanese.

In order to gain an idea of the temperatures that are favored by hand ironers, the iron was used under conditions of production for one week. Observations of the temperature were made on the millivoltmeter during the ironing operation and recorded. It was noted for the most part that a temperature of about 440° F. was favored by the operators for beginning the ironing of silk and rayon. Acting on this information, two elements were used, one having a cut-off range between 340° and 460° F.; the other had a range of 435° to 495° F. These irons were tried out under conditions of production. The iron having the higher range was preferred by the operators who used the irons. The objection advanced against the first iron was that it clicked off when it felt just about right, but cooled to such an extent that it did not reach the higher limits of temperature rapidly enough for efficient ironing. It is possible that this iron would have been more satisfactory had its lower limits of temperature been 400° F. instead of 340° F.

The iron having a range of 435° to 495° F. was used with the utmost satisfaction and safety on damp silk, rayon and linen with the current on at all times. It was observed that the operators turned off the current on very damp and heavy pieces, such as nurses' aprons and uniforms. This observation is contrary to some advertising that assumes that a very hot iron is required for such work. The reason for turning off the current when pressing such pieces is to avoid the possibility of producing a surface scorch before the comparatively heavy uniform material is dry. Heavy pieces must be dried as well as pressed, necessitating the use of considerable pressure and repeated going over. With too hot an iron, surface scorching is possible. It was observed that a steady temperature of about 420° F. was favored for this class of work.

In Table VII are shown the scorching temperatures of the fabrics that were tested when exposed to an iron for 1, 2 and 5 seconds, hygroscopic moisture only being present in each material at the time of test.

TABLE VII

Scorching Temperatures in Degrees Fahrenheit

Textile Material	Time of Contact in Seconds One	Two	Five
Cotton	510° F.	487° F.	442° F.
Viscose Rayon	463	...	375
Linen	447	425	403
Unweighted Silk	447	425	403
Wool	397	375	350

The following main points have been developed as the result of studying scorching temperatures:

1. There are any number of scorching temperatures, depending upon conditions.
2. The two main factors of control are the temperature of the iron and the length of exposure.
3. The amount of moisture present has a distinct bearing upon the problem.
4. Although equal intensity of scorch has been reported to be accompanied by an equal tensile strength loss after a 30-second exposure at elevated temperatures, no such losses were observed after exposures up to 5 seconds, even though the scorching was noticeable.
5. Hand ironers were found to prefer an electric iron having a temperature range between 435° and 495° F.
6. Operators were observed to turn off the current when pressing damp and heavy nurses' uniforms, etc., to avoid surface scorching. A temperature of 420° F. was preferred for this type of work.
7. Wool was found to be the most susceptible of all fibers to scorching or yellowing and cotton the least.
8. Viscose rayon, linen, and unweighted silk fall between wool and cotton as far as scorching is concerned.
9. Cellulose-acetate fibers stick to the iron at too high a temperature and actually melt. "Iron-proof" cellulose-acetate is far more resistant to melting.
10. The following limits of practical ironing temperatures are recommended for automatic electric irons used under power-laundry conditions.
    a. Wool, 340° to 400° F.
    b. Cotton, linen, rayon and washable silks, 435° to 495° F.
    c. Celanese and other cellulose-acetate fibers, steam-heated presses or irons that are really cool.

By an ironing temperature of 340° to 400° F. is meant one wherein the current is automatically shut off at 400° F. and turned on again when the ironing temperature drops to 340° F.

Ironing Precautions for Cellulose-Acetate Pieces

The cellulose-acetate types of fiber (Celanese and Acele) instead of scorching at elevated ironing temperatures, tend to melt. It was observed that Celanese sticks lightly to iron at 387° F. The same samples puckered instantaneously and became glazed at 421° F. A sample of so-called "iron-proof" Celanese showed no tendency whatever to glaze or melt when similarly exposed at temperatures as high as 500° F. It also was observed that different samples of cellulose-acetate materials showed varying degrees of heat resistance. It was noted in such instances, as in the case of the "iron-proof" sample, that

the cellulose-acetate fabrics, which were the more resistant to high temperatures, were less easily dissolved in acetone than fabrics that melted at lower temperatures.

It should be kept clearly in mind that in all this work, the scorching or melting temperatures that were observed were obtained with samples containing hygroscopic moisture only. Under operating conditions, even after textiles have been centrifuged, considerable moisture is left in the pieces. This moisture naturally has a tendency to reduce the ironing temperature of the iron as is shown in Table VIII.

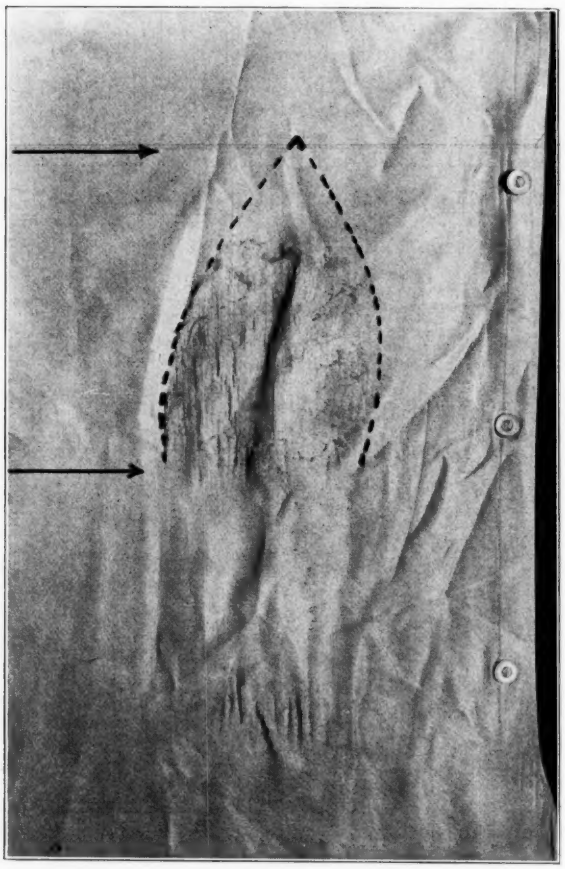


Fig. 5

When cellulose-acetate is pressed at too high a temperature or if a hand-ironer uses too hot an iron or becomes careless, this type of fiber instead of scorching, tends to melt or fuse, at the same time becoming brittle.

As far as cellulose-acetate pieces are concerned, laundry employees should be instructed to finish them either on steam-heated presses, preferably at reduced steam pressures approximating 50 pounds per square inch, or with "cool" electric irons. In view of the high temperatures that some electric irons develop, however, it is a safer rule to recommend the handling of cellulose-acetate pieces entirely on presses operating at reduced steam pressures, since the temperatures of the steam-heated machines usually are sufficiently below the fusing point of cellulose-acetate to prevent any tendency for the synthetic fibers to fuse and become brittle.

Garments containing Celanese and similar fibers frequently, but not always, have a woven label marked with the word "Celanese" attached to them. Operators should be reminded that cellulose-acetate fabrics look very much like silk. When in doubt about any silk-like piece, operators should play safe and press it at reduced temperatures.

The Cooling Effect That Damp Pieces Have Upon Ironing Temperatures

The effect that the moisture, which is retained by any centrifuged piece, has upon the ironing temperature of a press or iron obviously is a cooling one. Table VII graphically illustrates the extent to which an electric iron cools during use. The greatest drop in temperature on an average occurs in each case during the first two minutes of pressing.

When the article that is being pressed dries, rapid tendency towards cooling stops, while slight increases occur after the first 5 minutes. It is this cooling action of the moisture that is present in damp pieces, which makes it possible for skilled operators to use ironing temperatures on wool, silk, and rayon pieces

TABLE VIII

Ironing Temperatures at Definite Time Intervals

Article	Original temperature of iron	Time in Minutes 1	2	3	4	5	6	7	8	9	10
Silk Shirt	385° F.	313° F.	289° F.	...	...	281° F.	...	289° F.	...	...	303° F.
Silk Shirt	419	351	327	...	...	315	...	315	...	...	331
Silk Shirt	415	349	305	...	...	305	...	305	...	...	315
Silk Shirt	459	393	349	...	349	...	...	371	...	...	371
Silk Bloomers .	415	...	...	371	...	...	...	...	...	...	...
Silk Combination	437	405	371	371	371	...	...	...	...	...	...
Silk Pajamas ...	415	...	...	...	...	371	...	...	...	...	...
Silk Pajamas ..	423	349	327	303	...	327	...	...	...	...	...
Silk Slip	415	371	371	...	...	...	...	...	...	...	...
Silk Slip	405	375	...	362	...	...	349	...	...	...	...
Silk Slip	349	...	327	...	327	...	...	...	...	...	...

that an untrained employee could hardly use with safety, especially in the case of wool and cellulose-acetate pieces.

Temperatures at Which Steam-Heated Machines Should Be Operated

From Table II it is evident that the temperature of an ironing machine operating at 90 pounds steam pressure is about that at which bleached cotton cloth begins to deteriorate, if heated dry for any length of time. This deterioration, as Clayton has demonstrated, is not at once evident as a scorch. As a matter of fact, there is no immediate evidence of scorch on the padding or covering of a press or flatwork ironer that is operated at 100 pounds gauge pressure. The element of time enters into the effect of temperature on padding, a fact that is illustrated by the manner in which the covering of ironing equipment develops a more pronounced scorch on each succeeding day that it is used. If it were not for the cooling effect that results from the evaporation of moisture from the wearing apparel and flatwork that are being ironed, the padding and covering would deteriorate more rapidly than they actually do.

The correct temperature at which to operate an ironing machine is a subject that requires consideration from a practical point of view for the reason that a flatwork ironer, for example, must be used to iron both heavy and lightweight goods, such as spreads and sheets. A sheet may be ironed dry by one pass through a machine, whereas a spread may require two or three passes before it is ironed dry. It is quite evident that a machine that would iron a heavy spread with one pass would dry a thin sheet long before it had passed through the ironer, a practice that would expose dry sheets to the action of high temperatures for the remainder of the time that they remained in the machine. Logically, the correct thing to do is to choose ironing temperatures that are designed to properly iron the bulk of the work coming to the ironer. The heavy pieces, being in the minority in most cases, may be repassed until properly pressed.

It must follow that since the temperatures resulting from the use of saturated steam at 90 to 110 pounds gauge pressure approach the point at which bleached cotton cloth may undergo a loss of tensile strength, if heated dry for too long a period, it would be unwise to operate an ironing machine at higher temperatures than are used in existing practice. As far as presses are concerned, both heavy and lightweight garments made of cotton, wool, silk, and rayon are finished on these machines. The press-operator is able to determine the length of time that is necessary to dry any particular fabric.—*Bulletin L.N.A.*

The Fulton Dye and Import Company, Inc., has announced the removal of its offices as of the first of May to 11 Park Place, New York City.

The Future of Color Co-ordination

***By* WALDON FAWCETT**

SUCH has been the need for a simple device to discipline the colors of seasonal fashion that it is small wonder that the co-operative movement for color co-ordination, so-called, has been hailed as a logical and practical solution for this pressing problem. In the first flush of enthusiasm it has been assumed, indeed, that if color concentration can be accomplished in the apparel field, its influence will extend automatically to other branches of the textile industries, as, for example, the fabrics destined for interior furnishings; a quarter where the consideration of "backgrounds" for feminine apparel is an incentive to color harmony.

As arrangements have proceeded, however, for organized or standardized color correlation, it has become apparent that complete success is dependent not so much upon widespread acceptance of the basic principle of color concentration as upon the policies adopted to bring concert of action on the part of color users. Specialists in color and specialists in marketing practice have itemized several factors which they are confident will exert controlling influence upon the future of color co-ordination.

The first contingency they foresee concerns the extent of the acceptance of the ideal of color compromise throughout the apparel industries and related or accessory lines. It is no secret that certain sections of this far-flung field have not as yet accepted the plan for a mutual color card. Hesitation may be natural until the project has found itself and proven itself. But it is obvious that 100 per cent acceptance of the elect color range is desirable if not essential to the fullest success of the color pool.

A second element hanging in the balance, and one that will react potently upon the first factor, above-mentioned, is the nature and extent of the latitude to be allowed individual co-operators or classes of co-operators in the color correlation program. Presumably, there can be no concessions as respects the colors themselves, but it has been suggested that a certain desirable elasticity might be imparted to the system, via incidentals. An illustration of the ruses for flexibility, already invoked, is found in the arrangement whereby color co-operators are allowed free rein in the use of private, distinguishing color names for the conventionalized colors.

Yet another equation that must be reckoned with in the future of color co-ordination is the measure of aid, if any, which may be expected from Governmental support and encouragement of this particular adventure in color economy. For all that, the need of color regulation is so recent a development, the Department of Commerce has

already received appeals from various industries which seek Federal sanction or sponsorship for experiments in color control. Several communications to this end have come from the textile industries, as witness the gesture of certain manufacturers of hosiery.

On general principles, the Commerce organization stands ready to do anything in its power to reduce waste or loss in industry through undue diffusion of effort, whether expressed in excess sizes, patterns, colors, or what not. The fact remains, however, that, in most undertakings to date, Uncle Sam has been intent upon encouraging straight numerical simplification in a permanent structure. It remains to be seen how far the Government, if asked, can go in furtherance of a program that, to begin with, involves arbitrary selectivity of colors and that, furthermore, involves a revision of schedule several times a year.

Finally, in the estimation of the trained observers, who are standing by, the future of color co-ordination will be scaled to the success of the administrators in "picking winners." It is assumed that with the fashion forecasting facilities at the disposal of the co-operating forces there can be no doubt of the ability of the color arbiters to foresee and discount style trends, etc., which will have a color reflex. But, how about the unforeseen? What if a producer in the dyestuff industry suddenly stumbles upon a gripping novelty? In other words, the professional watchers on the side lines are asking whether, after all, the dyers do not hold, in unsuspected degree, the key to any plot for the rationing of colors, and whether it is not necessary to insure the co-operation of these interests rather than to put the cart before the horse by first attempting complete conversion of the forces of distribution.

In the estimation of some conservatives, the most favorable augury for the future of color co-ordination is to be found in the policy of concentrating on a limited number of basic ensemble colors. Given a nucleus of, say, ten basic colors, selected with due regard for the requirements of daytime and evening wear, and it is believed that virtual unanimity of acceptance may be obtained. The restriction in number would allow the leaders to be put into production very generally by supply houses, yet would afford opportunity for endless gradations designed to produce color harmonies and bi-color indulgences for the sake of contrast.

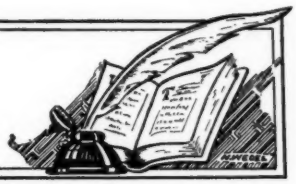
Literally, the fate of color co-ordination is in the lap of the retailer. While it is coming to be generally accepted that initiative in color control should come from the producers, a close examination of the situation shows that dealer-acceptance is the prime requisite for the success of each and every national color card. The disquieting note in all this is that not a few merchants in apparel lines stand revealed as favorable to the theory of seasonal specialization on set colors but as reluctant to bow to the color mandates of any central authority, however well constituted. It is to temper this independence of spirit in certain retail quarters that the champions of color co-ordination under union auspices have recounted, in their promotional literature, what has befallen individual stores and merchants' buying groups that now or again chose colors for ensemble purposes only to find that the market did not afford scarfs, handkerchiefs, bags, shoes, hosiery, garters and all the complimentary specialties and accessories in sympathetic shades. The keynote of all missionary work is that satisfactory color co-ordination by any individual store or group is dependent upon some system of market-wide standards for basic colors for each season.

Assuming that the result of the present campaign is to bring into line for national color conformity the majority of large retail operators, there will extend into the future a considerable responsibility for keeping these retailers satisfied. For demonstration, we may say, that color co-ordination is not only an economic advantage to the store, but is satisfying in its operation to the majority of a store's regular customers. The basic colors must, for example, be wearable by a large variety of customer types, must allow for the vogue in complexion tones and the mode in hairdressing as well as the trend of Paris fashion. The best guessers are predicting that even if tomorrow, or the day after tomorrow, brings a longer list of colors for color correlation, we will continue to have for master colors only subdued tones, susceptible of an infinite variety of "matches."

Admittedly, one of the big jobs ahead for color co-ordination is the overcoming of the tradition or superstition on the part of so many retailers that, for the sake of store prestige, a store must boast its own set of colors. Particularly there is the prejudice on the part of high-grade stores against handling colors identical with those in the popular-price stores. As an escape from this dilemma, the promoters of color co-ordination are encouraging the featuring of standard colors under private color names. Furthermore, the sponsors of color co-ordination, far from prescribing narrow concentration on the basic ensemble colors, are counseling the promotion from time to time of odd or "prestige" colors, so long as these high-style colors are not just different enough from the co-ordinated colors to "fight" if used in the same ensemble. Enthusiastic converts to color co-ordination predict that when the millenium is attained, retailers will make not less than 85 per cent of their total sales on, say, ten correlation chart colors and on an equal number of associated or "accent" colors, leaving only 15 per cent of the turnover to go into the high-style or prestige colors.

The new circular, I. G. 400, recently issued by General Dyestuff Corporation, introduces Humectol C, a new dyeing auxiliary. Humectol C is claimed to be better and cheaper than Turkey red oils as a wetting-out agent. It is also said to retain its wetting-out properties in alkaline baths even at high temperatures.

Technical Notes from Foreign Sources



Microscopically Visible Impurities in Viscose and Viscose Silk

Dr. Rudolph Bernhardt—Kunst-Seide 11,13 (1929).—The author has taken occasion, from a recent article by Dr. Vollprecht upon "Defects in Artificial Silk Fabrics" (Leipzig. Monatsschr., Dec. 1926), to consider the source of such defects, and of others which might be detectible in the unwoven fiber, by microscopical study. As the scope of such studies is limited to the woven goods in most cases, since defects are not evident until detected, and the unsatisfactory goods are returned for adjustment, B. has undertaken the study from the other side; i.e., he considers it first of all from the standpoint of the viscose solution before spinning. Items which have to be considered are:

1—The content of the cellulose-source as to inorganic and organic impurities,

2—Impurities in the caustic soda,

3—Salt-content of the water used (which can be easily controlled),

4—Absorption of CO_2 from the air, with formation of insoluble carbonate (in the viscose),

5—Possible, though slight, dissolving of iron from the apparatus,

6—Possibly the content of carbon disulphide in the viscose,

7—Incompletely disintegrated particles of cellulose-material escaping causticizing and sulphiding.

As all these factors, if involved, must vary greatly from time to time, he considers them only from the qualitative standpoint.

As to the removal of solid impurities by filtration, even the 4-6-times repeated filtration commonly practised does not completely clear the viscose. The author's idea was, to prepare optically pure viscose, and to stud the effect of the introduction into it of various impurities, such as would probably be encountered in actual practise as well as to study the effect of various degrees of ripening, etc. To obtain really optically pure viscose, he was obliged to filter "pure" viscose through a Jena glass-filter of the finest porosity. A number of the possible inorganic impurities to be suspected was studied, their presence in the viscose being clearly to be detected. As to organic contaminants, such as wood-gum, resin-acids, and fatty acids, these might be introduced as hardly avoidable contaminants of the wood-pulp. Microscopically, the addition of such substances to pure viscose could not be detected, yet their presence naturally, so to speak, in viscose prepared from wood-pulp containing them and not carefully purified, was plainly visible in such viscose, evidently in the form of calcium compounds; so that, obviously, the lower the ash-content of the pulp, the less the danger from this source (addition of the free acids, etc., of this nature gave no cloudiness or precipitation unless calcium salts or hydroxide, with which they could form salts, were also present).

Presence of undisintegrated fiber from the pulp leads to a result hardly to have been anticipated. The coarser particles, naturally, are removed from the raw viscose fairly completely by the repeated filtration to which the viscose is always subjected. The finer particles which escape filtration pass through the spinnerets, and are present in the nascent fiber, but, as the forming fiber begins to contract, and the trapped gases escape, these finer particles are forced to and through the surface of the fiber, and are washed off in the bath, yet they leave the surface of the shrunken fiber decidedly pitted, and so rather jagged in cross-section. No traces of the fibrous pulp-substance are visible in either longitudinal or cross-section of the fiber, only, in cross-section, the pits which their escape has left. Such a cross-section would locate the trouble in a sample complained of. In connection with this point, it may be remarked that after-treatment of spun viscose, for the purpose of removing the customary foreign material as far as possible, and also scrooping, if carried out carelessly, may so damage the fiber as to give it here and there, in cross-section, this same otherwise characteristic appearance.

Several reproductions of good photomicrographs accompany the article.

Iron Carbonyl and German Patent No. 441,179

H. Pomeranz—Mell. Textil-Ber. 9, 843 (1929).—Very few iron compounds are employed in dye-technique—ferrous sulphate, the acetates, the nitrate, and potassium ferrocyanide. There seems to be no general or comprehensive treatise in existence on the subject of the metallic compounds used in textile work; such matters are dealt with only in a specifically incidental way. The newest iron compound to be recommended for various textile purposes is the peculiar iron carbonyl, $Fe(CO)_5$, formed by reaction between carbon monoxide and metallic iron; a liquid resembling benzine superficially, immiscible with water, but mixing completely with such substances as the hydrocarbons, alcohol, etc. An analogous compound is nickel carbonyl, $Ni(CO)_4$, and perhaps also the peculiar compound $K_6(CO)_6$, which is generally considered to be the hexa-potassium salt of hexa-hydroxy-benzene.

Iron carbonyl acts as a reducing agent for aromatic nitro-compounds, and for our purposes, for vat dyestuffs. This latter use is the point of German Patent No. 441,179,

which apparently has not attracted much attention. Of this patent, in some ways a remarkable one, examples 3 and 4 describe the vatting of indigo with iron carbonyl, in presence of caustic soda (and of course water, though the reducing agent is not soluble in water) according to slightly different methods, each of which, however, is strictly a laboratory method, involving the use of a condenser. The author, studying the patent, notes certain facts:

1—The vatting in presence of excess of dyestuff proceeds more slowly and difficultly than when the reducing agent is present always in excess.

2—As the reduction apparently proceeds, one iron atom in the pentacarbonyl compound is equivalent to 3H, or 1½ mols. of Rongalite C, or, in other terms, the reducing power of 196 parts of iron carbonyl is equal to that of 177 parts of Rongalite C. If, however, the oxidation of the iron proceeds only to FeO (it is assumed to go to ferric oxide in the above), then 118 parts of Rongalite C would be equivalent to 196 of the carbonyl compound, and to 556 parts of ferrous sulphate.

If the iron carbonyl could be incorporated successfully into a printing-paste by use of some suitable thickening-agent, and then, through a short passage through hot concentrated caustic, changed to ferrous hydroxide in the nascent state, the problem of the ferrous hydroxide-indigo discharge would be solved.

Detailed information about the new compound is given by Dr. A. Mittasch in Zeitsch. f. angew. Chemie, p. 587, series 1928.

Wool Viewed as a Chemical—Its Formation and Processing

A. T. King—Text. Mercury 31, 414 (1929).—An abstract of a lecture delivered before the Keighley Textile Society.

Wool fiber occupies a unique position among other textile materials, in being essentially a completely finished product when turned out, so to speak, by nature; there is no varying degree of ripeness, etc., regardless of how long the material has been growing. This point of view has been unconsciously adopted by the manufacturer, whose sole demand is that the wool fiber be delivered to him in undamaged, natural condition. The processes of scouring and cleaning, milling, dyeing, finishing, etc., all take place in generally uniform ways, and, if any modifications seem to be necessary, his experienced judgment is able to bring the necessary modification about. This is not the case, e.g., with artificial silk, where a thorough knowledge of the original material and its mode of working up is really essential to a perfect utilization of the fiber. Yet it may be considered that, though such knowledge in regard to wool has not up to the present been regarded as necessary, or even of use, yet such an intimate acquaintance with wool as a chemical substance might well be of a value as yet quite unsuspected. This is the viewpoint of the author.

He reviews the question of the chemical composition of wool from the standpoint of its degradation-products—the amino-acids. So far, such cleavage-products are obviously of a very simple nature in respect to what is evidently a very complicated complex, keratin. It should be possible to devise means of splitting the keratin molecule, by milder means than have thus far been employed, into less simple cleavage-products, i.e., substances higher up in the series than the better known, simpler amino-acids which thus far have proved to be the identifiable cleavage-products of wool; e.g., bringing about such slight degradation of the fiber as is practically brought about involuntarily by exposure or chemical processing, which so often produces marked alteration in its textile properties, especially in its dyeing affinities.

He regards the scheme of research based upon sulphur content determinations as being the key to other aspects, biological, physical, physico-chemical, and technical, of the study of the wool fiber, and as opening up a comprehensive research campaign which only a co-ordination of the aspects mentioned above will assure of results. He bases this belief upon the fact that sulphur is the characteristic component which distinguishes the keratin type of protein from others; that the simple determination of sulphur content gives the clue to the keratin present, and that cystine, the only protein in which sulphur has been isolated, is the key to the keratin structure. Rimington has recently proved that the sulphur present in wool is accounted for, practically entirely, as cystine. Thus, a sulphur determination gives the cystine content also. There may be present also a minute quantity of another organic sulphur compound, methionone, which may prove to play an important part in the metabolic changes involved in the formation of keratin, but its quantity is negligible as far as the chemical or physical properties of wool are concerned.

The cystine content of wool varies. The author believes that the cystine nucleus is the solidifying or keratinizing agent which converts the primary cell-forming substance into solid, compact wool cells, and gives some well-known facts of a biological nature, involved in the formation of the wool fiber viewed as a simple outgrowth upon the sheep's skin, to support his hypothesis. Australian experts claim that wool keratins from widely differing sources are of constant sulphur content; also, that the cystine content of the fodder limits the production of fleece. This can mean only that the variation in the amount of cystine taken up for keratin synthesis can vary only the weight of wool produced, and not its chemical character. We know that the cystine content of the diet is a limiting factor in the production of hair, a cystine-rich diet producing a heavy, and a cystine-poor diet a scanty, growth of hair upon, e.g., the pig, the rat, and the human body. But biological and nutritional studies as yet give us only general indications, and nothing fixed or certain in a quantitative way.

Other interesting points are also taken up. One of these brings out a fact known to be true, but little regarded; that each individual wool fiber, unlike those of other fibrous material, is of a very slight, but distinctly different

nature as to dimension, chemical composition, dyeing and staining affinities, swelling-power, etc.; that usually, in a given lot, most of the individual fibers probably approximate a fair average, but that a badly bred wool may be poor, not necessarily because the fibers as a whole are poor, but because in the lot the limits of variation are more widely apart than usual.

Viscosity Determination of Viscose—Isothermal Treatment

R. Weingand and E. Acker—*Kunst-Seide* 11, 419 (1929).—A full description of the following-up and checking, in the laboratory, of the different steps in viscose production. The apparatus necessary is fully described in detail.

Absorption of Dyestuffs as Test for Mercerized Cotton

Dr. N. Uerb—Zeits. f. Farben-Ind. 20, 247 (1929).—A review and discussion of the methods for distinguishing between mercerized and unmercerized cotton—the iodine-KI and the iodine-zinc chloride tests, the copper number, the methylene blue test, etc., the later of which is given most attention.

Vat Dyestuffs

German Patent No. 461,450—(*addition to G. P. No.* 412,053)—*I. G. Farben-Ind. A.-G.*—The original patent, No. 412,053, specifies the combination of benzanthrone with aromatic acid chloride. G. P. No. 430,558 amplifies the procedure by prescribing the anhydrides of aromatic dicarbonic acids. The present addition increases the scope of the original by involving simple aromatic carbonic anhydrides, such as benzoic anhydride or its derivatives, in the presence of aluminum chloride or similar condensing agents. The benzanthrone must have the peri positions free. Apparently the ultimate product in the case of simple benzoic anhydride is dibenz-pyrenequinone. Three examples are given.

Orange Vat Dyestuffs

German Patent No. 461,451—*I. G. Fadben-Ind. A.G.*—The starting point is 1-benzoylamino-4-hydroxyanthraquinone. It is already known that substitution of mono-acid alcohol radicals into the hydroxyl group of such a compound gives certain red vat dyestuffs (G. P. No. 225,-232 and G. P. No. 436,536, for example, cite such compounds incidentally). But such derivatives can be dyed upon cotton only from a cold vat. The present compounds dye vegetable fibers from warm or cold vat in bright orange tones of excellent fastness.

One example involves the introduction of, essentially, ethylene glycol. Then parts of the benzoylamino-hydroxyanthraquinone are mixed with 10 parts of the p-toluene-sulphonic ester of ethylene chlorhydrine and 10 parts of calcined soda, in 100 parts of trichlorbenzene, and the mixture boiled until none of the unchanged original anthraquinone compound can any longer be detected. The product, on cooling, is filtered off. It is a mixture, which can be separated into two constituents by crystallization from nitrobenzene. The more soluble one, which dyes cotton a yellow orange from a vat of the same color, appears to possess the $-O-CH_2-CH_2-Cl$ group in place of the original hydroxyl; the more difficultly soluble compound, which possesses about the same properties in general, carries the $-O-CH_2-CH_2-OH$ group instead. Presumably the unseparated mixture would work as well as a dyestuff; however, it ought to be possible, it would seem, to prepare one or the other of the two constituents by a simpler method, avoiding the use of a p-toluene-sulphonic derivative. In all, four examples are given, the products of which are all much alike.

Vat Dyestuffs

German Patent No. 456,763—*I. G. Farben-Ind. A. G.*—G. P. No. 255,641 cites yellow vat dyestuffs of the anthracene series, obtained by heating pyrazolanthrones with caustic alkalies. These yellow products are converted to vat dyestuffs of another nature, and mostly red, by treatment with alkylating agents (G. P. No. 301,554). The present patent covers the production of these latter substances by heating the alkylation-products of pyrazol-anthrones (e.g., the p-toluene-sulphonic alkyl esters) with alkaline condensing agents. One example is given, the product yielding a very bluish-red on cotton.

Air-Silk and Tubular Silk

Dr. Wilhelm A. Dyes—Kunst-Seide 11, 5 (1929).—A review of the patent literature relating to these fibers, by the well-known Berlin expert. The separate points emphasized in the different patents are commented upon briefly. It is a valuable digest of the patent-literature up to the present.

Microscopically Visible Impurities in Viscose and Viscose Silk

Dr. R. Bernhardt—Kunst-Seide 11, 85 (1929).—The earlier part of this paper has already been reviewed in these columns. In this, the closing section, the author discussed the visible occurrence of air-bubbles originating in various ways, the determination of the presence of oxycellulose (in which study only the fuchsine-sulphurous acid reagent was found to give positive results, the Scholl, the Schwalbe, and the Xylidine Ponceau tests failing), the tendency of resinous and fatty acids to bring about precipitations in the material, the determination of the oxygen content in the caustic liquor, and the need of great caution as to what sort of bath is used to brighten the shade of dyed material, in the case of basic colors mordanted with tannin. A number of good photo-micrographs illustrate the article.

Structure and Chemistry of Raw Cellulose Acetate Silk

James Scott—Text. Merc. 81, 235 (1929).—A short, suggestive discussion of some of the fundamentals of the fiber in question, illustrated by three photomicrographs.

Textile School Adds New Courses

The Textile School of North Carolina State College, in order to give its students a wider variety of instruction in the design, manufacture, finishing and distribution of textiles, has rearranged its curricula and added a number of new courses. Textile students now have the opportunity to pursue the general course in textile manufacturing or major in yarn manufacturing, weaving and designing, or textile chemistry and dyeing.

Clemson Textile School Makes Improvements

During the summer months many improvements have been made in the Textile School at Clemson College, S. C. Not only has considerable new equipment been added in each division but all equipment used during the past session has been overhauled in preparation for the large number of textile students already enrolled for the opening of school in September. Although for the past two years Clemson Textile School has had the largest textile enrollment in the South, the indications are that the enrollment for 1930-31 will be even greater. The students are specializing mainly in Textile Engineering, Textile Chemistry and Dyeing, Weaving and Designing, and Textile Industrial Education.

General Dyestuff Release

General Dyestuff Corporation announces their domestic manufacture of Benzo Blue 2BA Extra, a direct color said to be well suited for the dyeing of all kinds of cotton or rayon material. It is recommended for bright shades where fair fastness properties and a very low cost is desired.

As a new brand of the Palatine Fast series the General Dyestuff Corporation offer Palatine Fast Black RRNX which produces a bloomy black of a purplish hue.

It is stated that the very good fastness to light, perspiration, washing, water and saltwater make the new brand a valuable product for the dyeing of woolen material for men's wear, better class of ladies' dress goods, knit goods, etc.

It is also said to be suitable for the dyeing of pure and tin weighted silk and of interest for printers of woolen and silk piece goods.—*Circular I. G.*—402.

Two New Indigosols

Carbic Color & Chemical Co., Inc., agent for Durand & Huguenin S. A., has issued folders describing Indigosol Violet IBBF and Indigosol Purple IR. Both are said to be of particular interest in textile printing because of their good fastness properties, fine shade and easy method of application. They may be used for colored chlorate discharges and for aniline black resist styles.

New du Pont Vat Dyes

The dyestuff department of E. I. du Pont de Nemours & Company has placed on the market Leucosol Blue 2G Double Paste (patented), a vat blue developed particularly for the printing trade. It produces full bright blues which are greener in shade than Leucosol Blue G Double Paste.

It is said to be extremely fast to light and washing and suitable for application on cotton, silk or rayon which is to be used for dress goods, draperies and similar materials.

Leucosol Blue 2G Double Paste is claimed to have all the good qualities of the Leucosol colors as a class, being non-foaming, grit free and extremely homogeneous.

Another vat dyestuff possessing properties characteristic of the company's Ponsol and Sulfanthrene colors is Sulfanthrene Yellow R Paste, which produces brilliant greenish shades of yellow, and is said to be extremely fast to washing, chlorine and to the other destructive agents with which such a color is apt to come in contact, with the exception of light, against which it shows fairly good resistance.

Sulfanthrene Yellow R Paste is suitable for use on circulating types of closed machines and for the jig and padder, as it is claimed to have good penetration and solubility in addition to its level dyeing properties. Sulfanthrene Yellow R Paste is recommended for rayon goods, as well as cotton, as it produces attractive shades of equal strength on both fibers.

It prints exceedingly well on cotton and rayon, and is recommended in those instances when a vat ground is desired, as it discharges practically to a white with Sulfoxite C in combination with Leucogene W.

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Dyestuff Salesman with many years of Sales and Laboratory experience is desirous of a suitable position with Manufacturing concern. Advertiser has an extensive personal connection in various States and can give first-class references. Reply to Classified Box No. 608, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED

Young man for laboratory work in cotton piece goods dyeing and finishing plant in South Carolina. Must have some knowledge of chemistry and dyeing. State experience and salary expected. Address Classified Box No. 627, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.